Field manual

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HEADQUARTERS
DEPARTMENT OF THE ARMY

FM 44-4

OPERATIONS AND TRAINING

CHAPARRAL

Field Manual
No. 44-4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 29 June 1979

OPERATIONS AND TRAINING
CHAPARRAL

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The word "he" or "his" in this publication is intended to include both the masculine and feminine genders and any exception to this will be so noted.

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*This FM supersedes FM 44-4, 27 September 1971, including all changes; and (C) TC 44-4-2, 1 March 1978.

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PREFACE

OPERATIONS and TRAINING
CHAPARRAL

This field manual provides a brief description of the characteristics and capabilities of the basic Chaparral missile, MIM-72A, and the improved Chaparral missile, MIM-72C. It discusses the tactical use of the missile and the training of the crew. A detailed description of the basic and improved missiles can be found in TM 9-1425-586-10 and TM 9-1410-586-24, respectively.

The guidelines for the tactical employment of the basic Chaparral missile stated in FMs 44-1 and 44-3 are also valid for the improved Chaparral missile. The technique of fire for both Chaparral missiles is as stated in this field manual.

This manual focuses on the techniques and procedures used by the Chaparral squad to attack and destroy hostile targets. It consists of two parts:

PART I describes the Chaparral weapon system and tells how the squad uses it to engage enemy targets.

PART II discusses means available and techniques that are used to train the Chaparral squad to operate its weapon system.

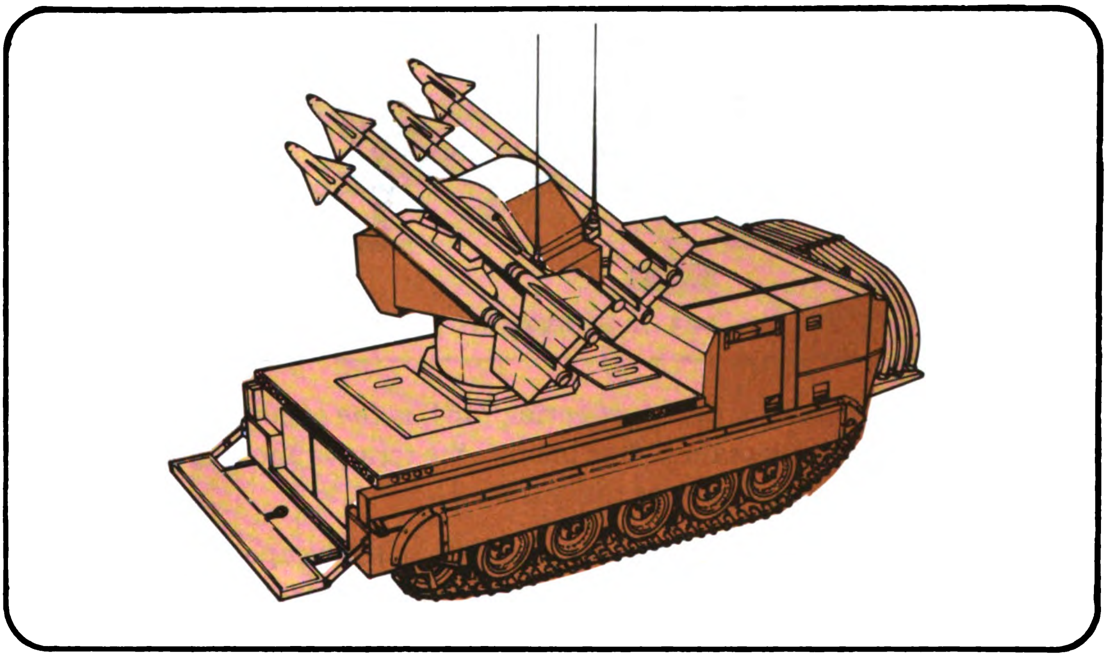
This manual should be used with the system technical manual (TM 9-1425-586-10) which tells how Chaparral works and how to maintain it. Information found in the technical manual, such as energizing and maintenance, is not repeated in this manual.

PART I

THE CHAPARRAL GUIDED MISSILE SYSTEM AND HOW TO USE IT

CHAPTER 1

DESCRIPTION OF THE CHAPARRAL SYSTEM



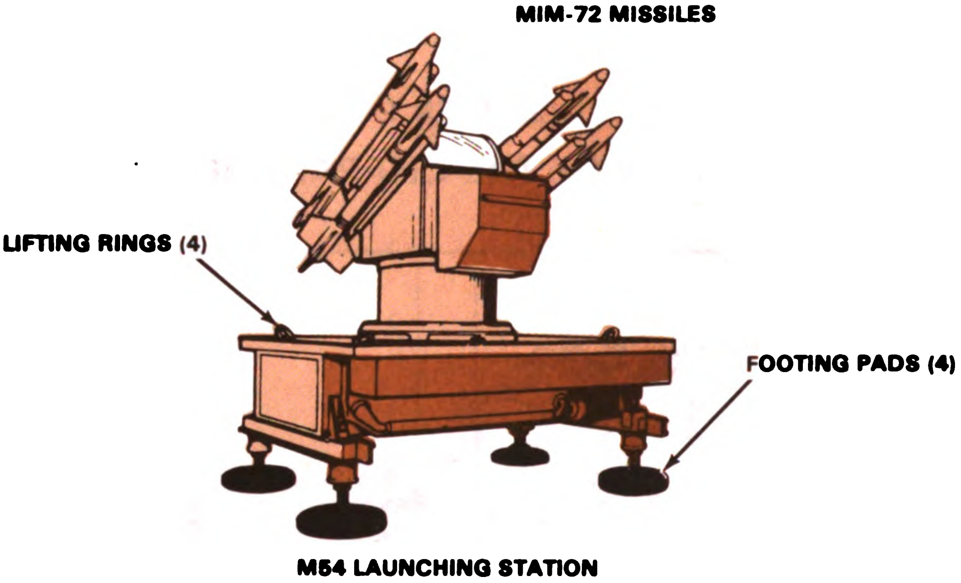
The Chaparral system (guided missile system, intercept-aerial, carrier mounted, M48) consists of a launching station (M54) mounted on a full-tracked carrier (M730). It fires Chaparral guided missiles MIM-72A and MIM-72C.

Chaparral is a self-propelled, surface-to-air, guided missile system fielded to protect the forward area against low-flying enemy aircraft. Visual target detection, tracking, and identification are required for conduct of effective fire by the Chaparral.

Chaparral is found in the Chaparral/Vulcan battalion of armored, mechanized infantry, and infantry divisions; and in nondivisional Chaparral/Vulcan battalions. The Chaparral is manned by short-range air defense missilemen in MOS 16P (10-30).

This chapter provides a brief description of the Chaparral guided missile system. A detailed description is provided in TM 9-1425-586-10.

LAUNCHING STATION

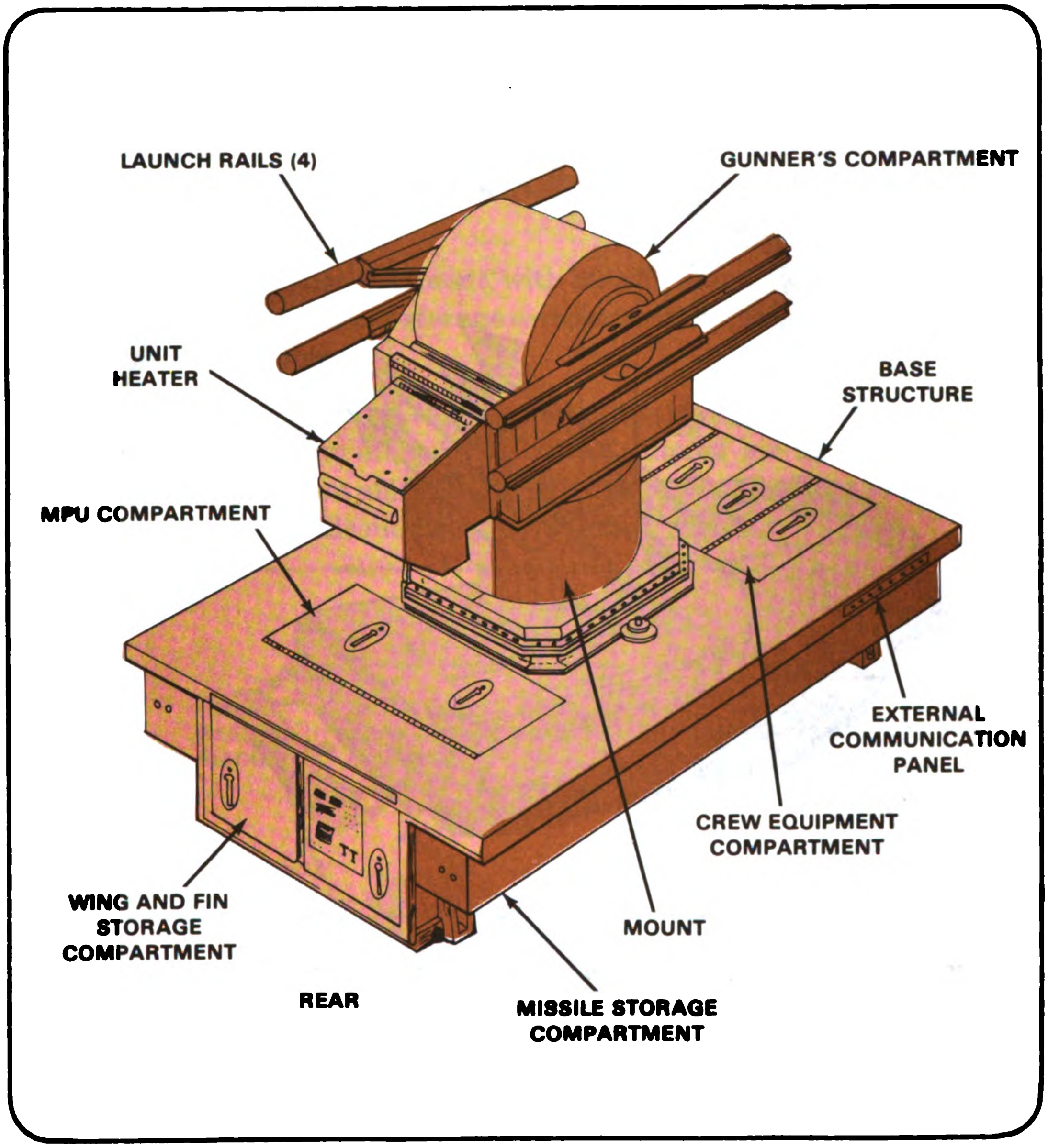


M54 LAUNCHING STATION

Guided missile system, intercept-aerial, M54, is the official name assigned to the Chaparral launching station. For brevity the term, launching station, will be used throughout the remainder of this manual.

The Chaparral launching station is an independent weapon system capable of launching missiles when the station is mated to, or separated from the carrier.

The station can be operated in a ground-emplaced mode.

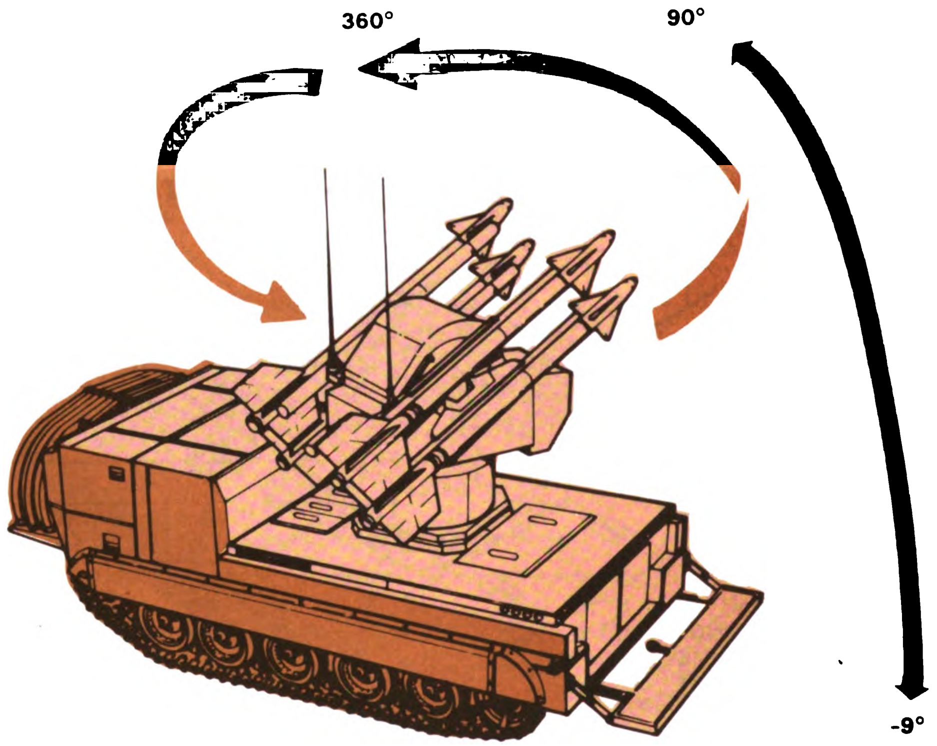

LAUNCH RAILS (4)
GUNNER'S COMPARTMENT
UNIT HEATER
BASE STRUCTURE
MPU COMPARTMENT
EXTERNAL COMMUNICATION PANEL
CREW EQUIPMENT COMPARTMENT
WING AND FIN STORAGE COMPARTMENT
MOUNT
REAR
MISSILE STORAGE COMPARTMENT

The launching station carries 12 missiles, 4 on launch rails and 8 in storage compartments located along the sides of the launching station.

It consists of two major units, a base structure and a mount. Located on the base structure and mount are components that furnish:

- Power
- Mount erection-retraction
- Mount drive
- Missile control and launch
- Missile air
- Environmental control
- Communications

MOUNT



The mount is the movable part of the launching station. It provides the gunner with the means for aiming and launching missiles. It has an inclosed, environmentally controlled compartment for the gunner and carries four ready missiles on its launch rails.

The mount can be rotated 360° in azimuth and its launch rails can be elevated in the vertical plane from -9° to 90°. For road travel the mount is retracted into the base, and must be erected before firing missiles.

THE BASE STRUCTURE:

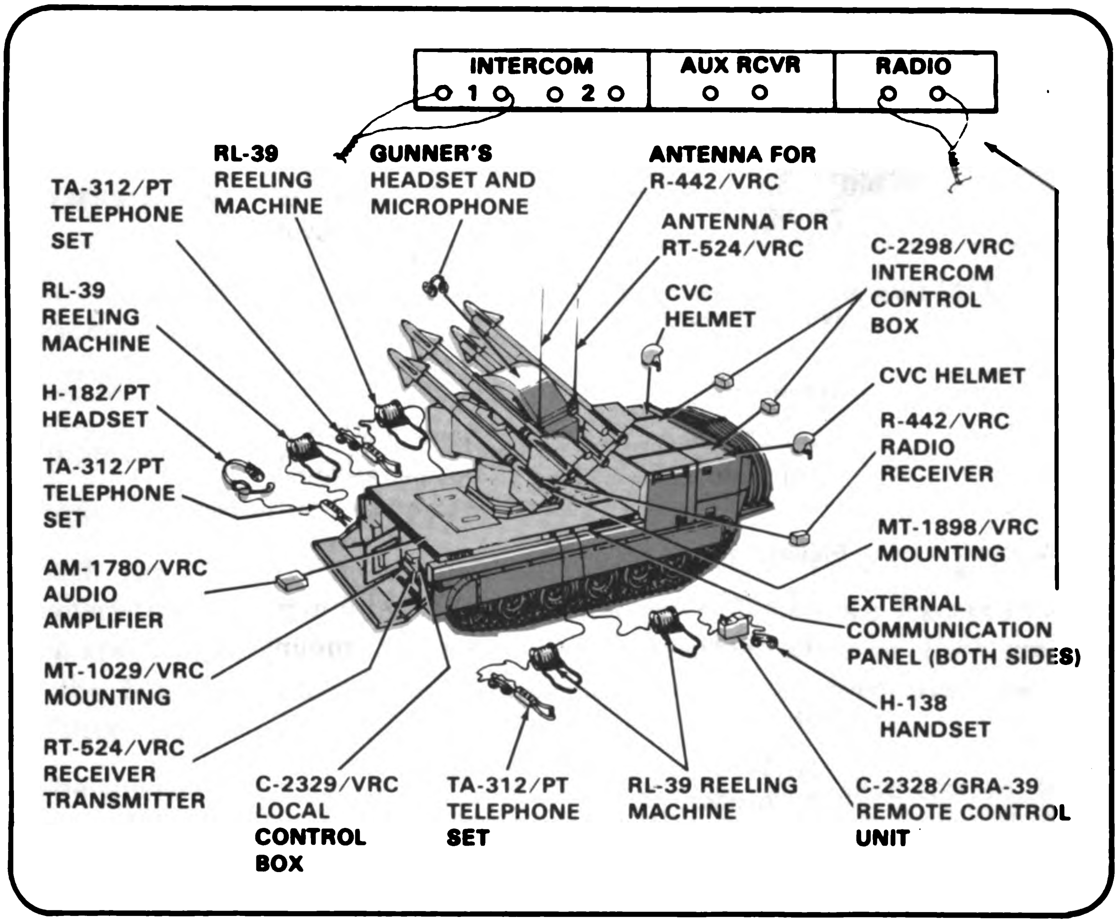
- Houses various items of the functional subsystems.
- Supports the mount.
- Provides storage space for missiles.

- Provides for the interface between the launching station and either the Chaparral carrier or ground emplacement jacks.

The top deck of the base structure is coated with material to provide protection against heat and blast when launching missiles. Access to the components mounted within the base structure is provided by doors in the top deck and one door at the rear of the structure.

One missile storage compartment, with bins for four storage cases, is mounted on each side of the structure. A storage compartment for missile wings and fins is in the rear of the structure.

The environmental control subsystem maintains a comfortable temperature in the gunner's compartment, provides fresh filtered air for the gunner, and maintains a slight positive air pressure within the compartment to exclude toxic gases generated during missile firings (hydrogen chloride).

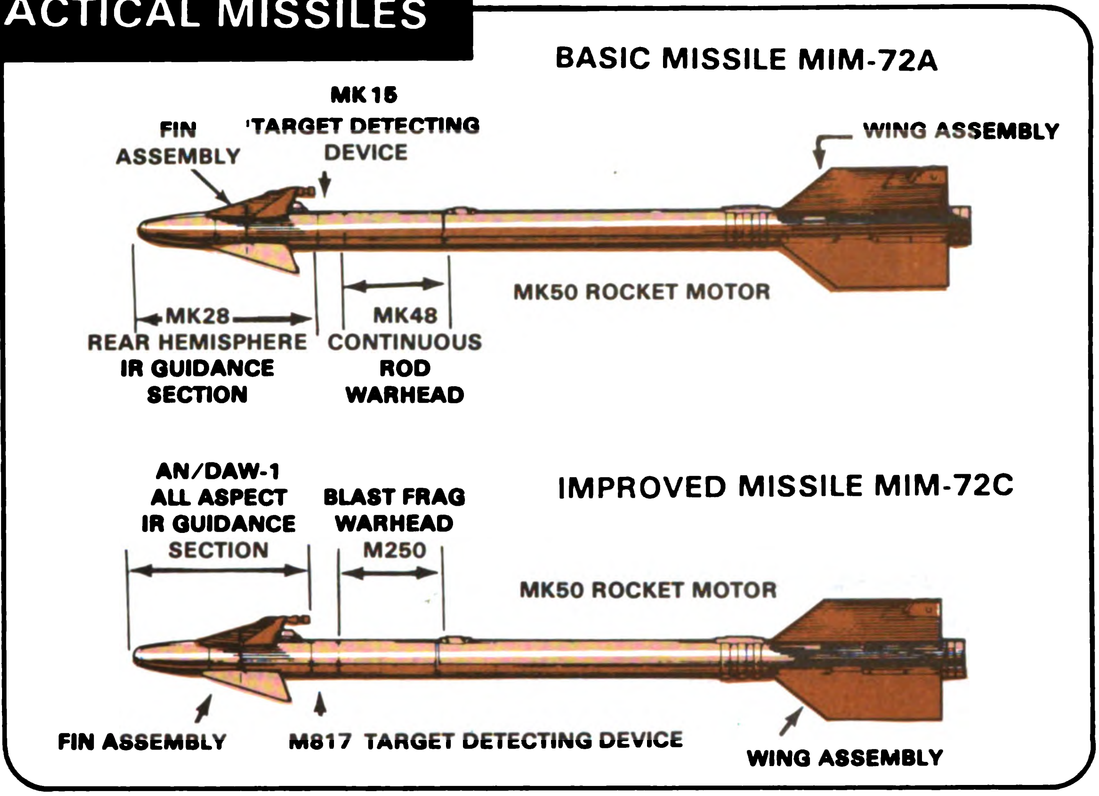


The communications subsystem provides for radio communications between the squad and platoon headquarters, and for voice communications between squad members. Communications can be operated from a remote location.

TABULATED DATA, LAUNCHING STATION, M54.

Base Structure	
Weight (w/o missiles)	10,000 pounds (4536 kg) (approx)
Length	10.7 feet (3.261 meters)
Width	7.8 feet (2.377 meters)
Storage	8 missiles, crew equipment, missile wings and control fins.
Subassemblies	Main power unit, system batteries, air compressor, communications.
Armor	None.
Mount	
Weight	4,138 pounds (1877 kg).
No. of launch rails	4
Traverse	
(a) Limits	None (360°)
(b) Rate	90° per second
Elevation	
(a) Limits	-9° to 90°
(b) Rates	60° per second
Sight	
(a) Type	Reflex
(b) Model	M75
(c) Magnification	Unity
Communications	Radio set AN/VRC-47, radio set control group, AN/GRC 39, intercom field telephones.

TACTICAL MISSILES


BASIC MISSILE MIM-72A
FIN ASSEMBLY
MK15 TARGET DETECTING DEVICE
WING ASSEMBLY
MK50 ROCKET MOTOR
MK28 REAR HEMISPHERE IR GUIDANCE SECTION
MK48 CONTINUOUS ROD WARHEAD
IMPROVED MISSILE MIM-72C
AN/DAW-1 ALL ASPECT IR GUIDANCE SECTION
BLAST FRAG WARHEAD M250
MK50 ROCKET MOTOR
FIN ASSEMBLY
M817 TARGET DETECTING DEVICE
WING ASSEMBLY

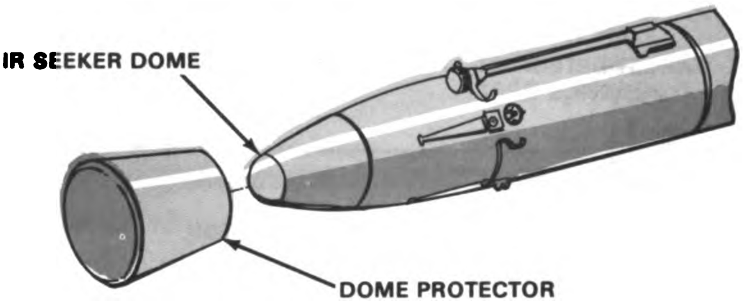
Both Chaparral guided missiles, intercept-aerial MIM-72A and MIM-72C are supersonic surface-to-air missiles using:

- Passive infrared target detection.
- Proportional navigation guidance.
- Torque converter control system.

Both are short-range air defense missiles. They have the same basic characteristics (e.g., size, weight, appearance, and composition). Except as noted in this manual, they have the same capabilities and limitations. Both are fired from the M54 launching station. Mixed rounds can be fired from the same launching station.

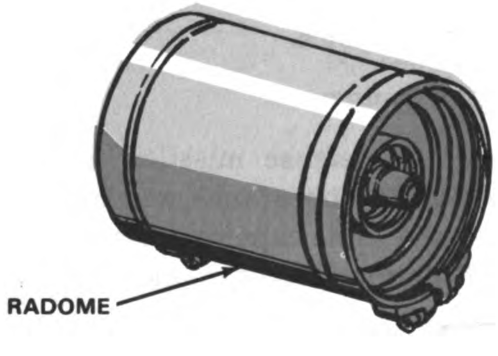
The missile is composed of seven major groups: guidance section, target detecting device, safety and arming device, warhead, rocket motor, wings, and fins.

1 THE GUIDANCE SECTION



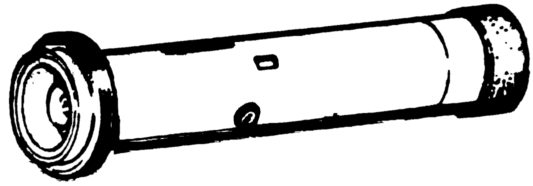
- Senses IR radiations of the target.
- Determines direction to the target.
- Generates signals that move the control fins to guide the missile to intercept.
- Produces an audio signal when the target's IR radiations are being received.

2 THE TARGET DETECTING DEVICE



The target detecting device functions as a proximity fuse when the missile comes close enough to the target. It also aids in causing the warhead to detonate on contact or to self-destruct if no contact is made.

3 THE SAFETY AND ARMING DEVICE

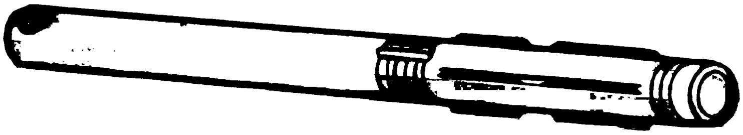


The safety and arming device prevents arming and detonation of the warhead during missile assembly and handling operations, and for the initial portion of missile flight.

4 THE WARHEAD

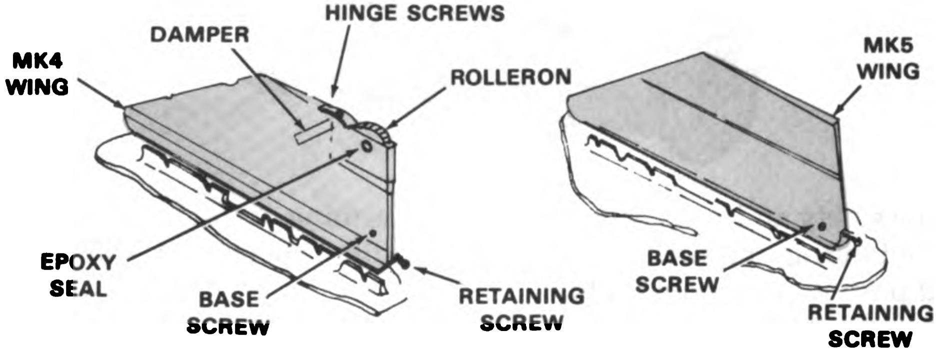
The warhead in the MIM-72A is of the continuous rod type. The warhead in the MIM-72C is of the blast fragmentation type. An explosive charge breaks the rods or fragments into individual projectiles capable of cutting through the structural members of most aircraft.

5 THE ROCKET MOTOR



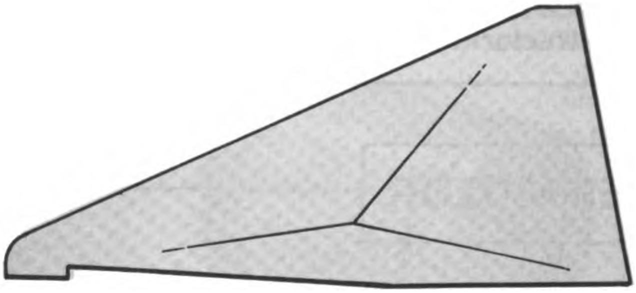
The rocket motor provides the thrust to launch the missile and propel it to the target intercept. The motor propels the missile to supersonic speeds.

6 FOUR WINGS



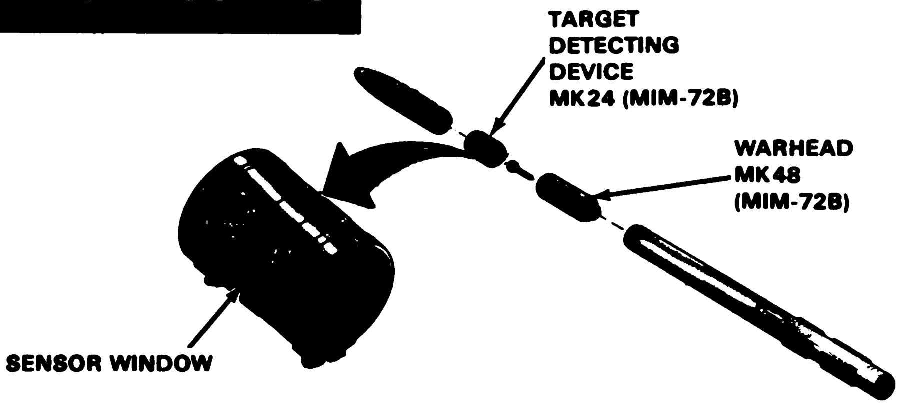
Four wings provide the missile with aerodynamic stability and reduce roll during flight. Rolleron assemblies on two wings function as automatic trim tabs for controlling the missile roll rate.

7 FOUR FINS



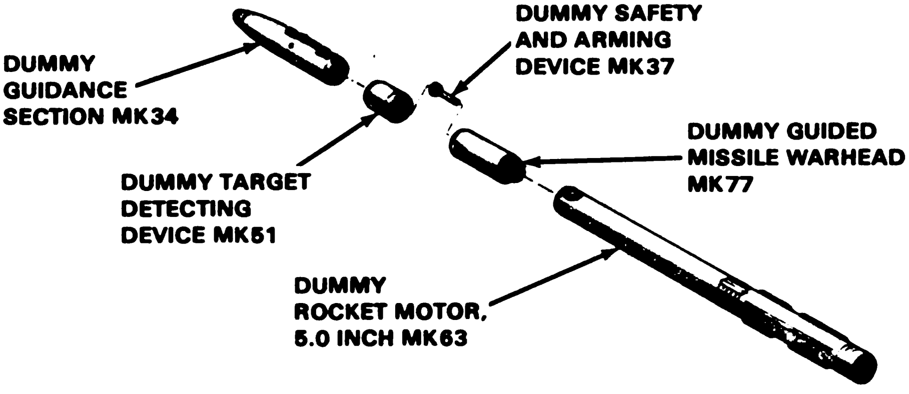
Four fins provide the control surfaces that guide the missile in flight. Guidance orders, generated in the guidance section, cause the fins to deflect into the airstream, thereby changing the missile heading as required to intercept the target.

TRAINING MISSILES



MIM-72B

Guided missile, intercept, aerial, MIM-72B may be issued for training purposes. It uses the MK24 target detecting device, which is adequate for training. It is otherwise identical to the MIM-72A. It is used for firing at drones and other practice aerial targets.



TRAINING MISSILE M30

Guided missile, training, M30, is completely inert. It is used as a handling missile for crew training in assembly, disassembly, loading and unloading. It's size, weight, and shape are the same as the tactical missiles.

When an MK-28 or AN/DAW-1 guidance section is substituted for the MK-34 dummy guidance section, the training missile can be used for tracking practice.

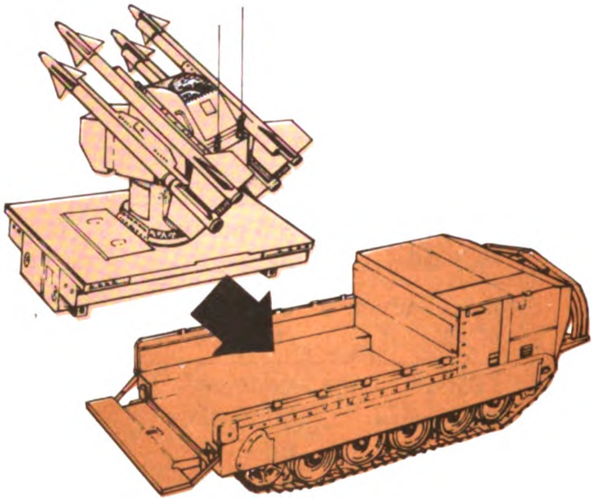
TABULATED DATA, CHAPARRAL GUIDED MISSILES

ITEM / MISSILE	BASIC MIM-72A	IMPROVED MIM-72C	TRAINING MIM-72B	TRAINING M30
Type	Supersonic, passive homing	Supersonic, passive homing	Supersonic, passive homing	Dummy
Weight	190 pounds (86.3 kg)	190 pounds (86.3 kg)	190 pounds (86.3 kg)	190 pounds (86.3 kg)
(in shipping container)	305 pounds (138.6 kg)	305 pounds (138.6 kg)	305 pounds (138.6 kg)	305 pounds (138.6 kg)
Length	9.5 feet (290 cm)	9.5 feet (290 cm)	9.5 feet (290 cm)	9.5 feet (290 cm)
Diameter, Body	5 inches (12.7 cm)	5 inches (12.7 cm)	5 inches 12.7 cm)	5 inches (12.7 cm)
Control Fin Span	16.4 inches (42 cm)	16.4 inches (42 cm)	16.4 inches (42 cm)	16.4 inches (42 cm)
Wing Span	24.8 inches (63 cm)	24.8 inches (63 cm)	24.8 inches (63 cm)	24.8 inches (63 cm)
Guidance Section	Passive infrared sensing	Passive infrared sensing	Passive infrared sensing	Dummy
Model	MK 28	AN/DAW-1	MK 28	MK 34
Weight (w/fins)	35 pounds (15.9 kg)	35 pounds (15.9 kg)	35 pounds (15.9 kg)	35 pounds (15.9 kg)
Length	24.3 inches (61.7 cm)	24.3 inches (61.7 cm)	24.3 inches (61.7 cm)	24.3 inches (61.7cm)
Seeker	Gyro-stabilized telescope, IR detector	Gyro-stabilized telescope, IR detector	Gyro-stabilized telescope, IR detector	Dummy
Warhead	Continuous rod	Blast fragmentation	Continuous rod	Dummy
Weight	25 pounds (11.35 kg)	25 pounds (11.35 kg)	25 pounds (11.35 kg)	25 pounds (11.35 kg)
Length	12.2 inches (31 cm)	12.2 inches (31 cm)	12.2 inches (31 cm)	12.2 inches (31 cm)
Target Detecting Device	Radio frequency	Directional doppler	Infrared	Dummy

TABULATED DATA, CHAPARRAL (CONTINUED)

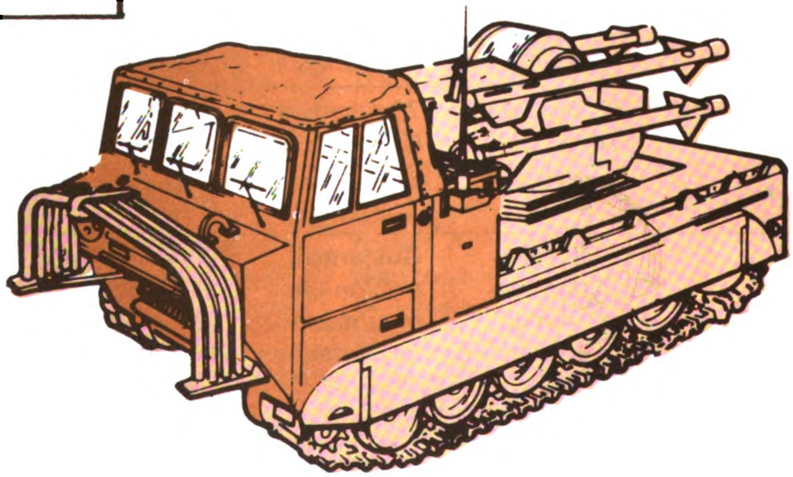
ITEM / MISSILE	BASIC MIM-72A	IMPROVED MIM-72C	TRAINING MIM-72B	TRAINING M30
Model	MK15	M817	MK24	MK51
Weight	9.5 pounds (4.3 kg)	9.5 pounds (4.3 kg)	9.5 pounds (4.3 kg)	9.5 pounds (4.3 kg)
Length	6.75 inches (17.1 cm)	6.75 inches (17.1 cm)	6.75 inches (17.1 cm)	6.75 inches (17.1 cm)
Safety & Arming Device	Launch latch, time interval, sustained acceleration	Launch latch, time interval, sustained acceleration	Launch latch, time interval, sustained acceleration	Dummy
Model	MK13	MK13	MK13	MK13
Activiation	180 to 340 meters from launch point.	180 to 340 meters from launch point.	180 to 340 meters from launch point	None
Rocket motor	Single chamber	Single chamber	Single chamber	Dummy
Model	MK50	MK50	MK50	MK63
Weight	96.7 pounds (43.95 kg)	96.7 pounds (43.95 kg)	96.7 pounds (43.95 kg)	96.7 pounds (43.95 kg)
Length	72.4 inches (183.9 cm)	72.4 inches (183.9 cm)	72.4 inches (183.9 cm)	72.4 inches (183.9 cm)
Control fins (No.)	4	4	4	4
Location	Guidance section (demountable for storage).	Guidance section (demountable for storage).	Guidance section (demountable for storage).	Guidance section (demountable for storage).
Wings (No.)	4	4	4	4
Model	(2) MK 4 to reduce roll rate. (2) MK 5. MK 4 and 5 provide stability	(2) MK 4 to reduce roll rate. (2) MK 5. MK 4 and 5 provide stability	(2) MK 4 to reduce roll rate. (2) MK 5. MK 4 and 5 provide stability	(2) MK 4 and (2) MK 5.

CARRIER



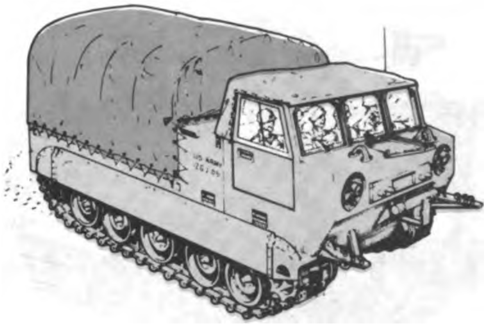
System mobility has been achieved by mating the launching station to an M730, 6-ton, full-tracked cargo carrier. Four bolts hold the launching station to the carrier cargo bed. A single cable connects the communications system in the launcher to that in the carrier cab.

VEHICLE CAB



The vehicle cab has a seat the full width of the cab that will carry four passengers and the driver. The cab is normally open, but a soft cloth or hard fiberglass cover can be installed to provide the crew protection from the elements.

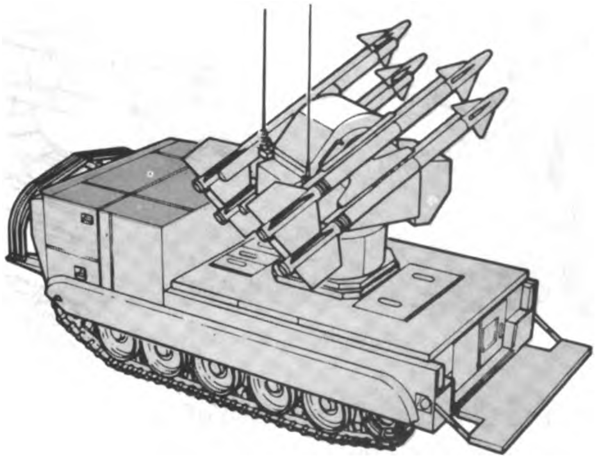
CARGO COVER



A cargo cover may be installed to protect the launching station from the elements outside the combat zone. The outboard wings on the upper right and upper left missiles, and the radio antenna must be removed to allow the cargo cover to be put on.

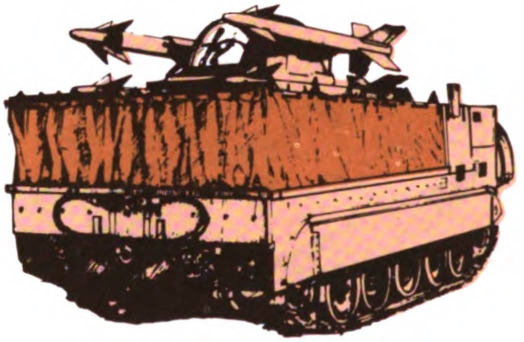
The cargo cover, when installed, can deceive the enemy as to the cargo and purpose of the vehicle. All of these covers must be removed before firing missiles.

BLAST COVERS



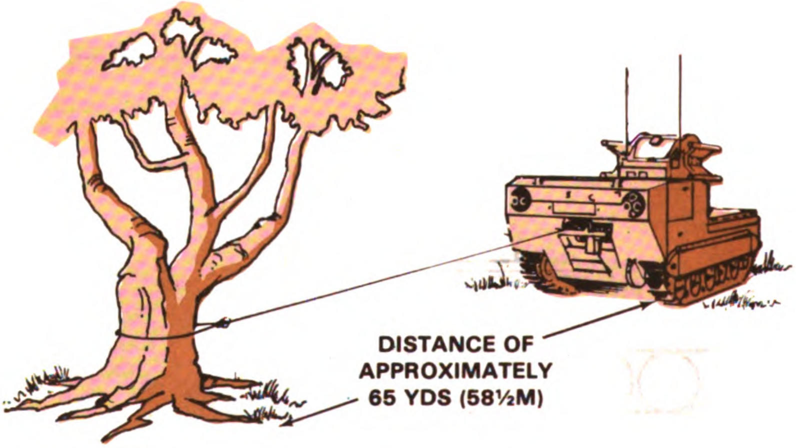
Blast covers, covered with an erosion and heat resistant material, are folded over the cab and engine compartments to protect them from the heat and blast of the rocket-motor exhaust generated at missile launch.

MOBILITY



The M730 has a forward speed of 38 mph (61 kmph) and a cruising range of 300 mi (482.8 km).

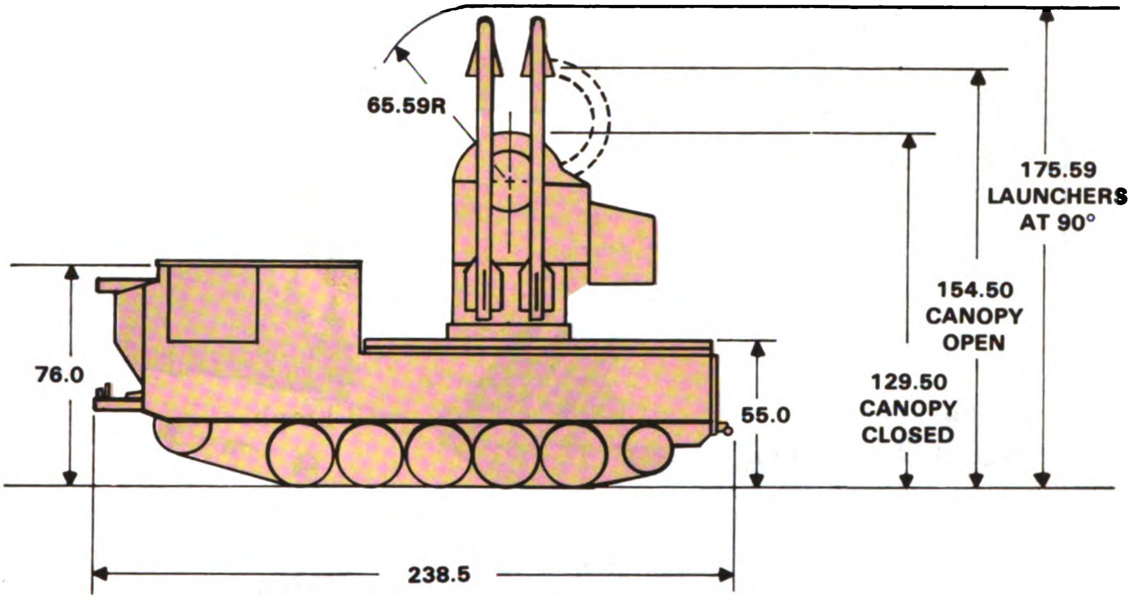
The M730 can ford streams up to 40 inches (101.6 cm) deep at speeds up to about 3 mph (4.8 kmph). The depth limitation includes the height of waves and splashes. A swim kit can be installed that will enable the Chaparral to cross water deeper than 40 inches, provided wave height does not exceed 12 inches (30.5 cm).



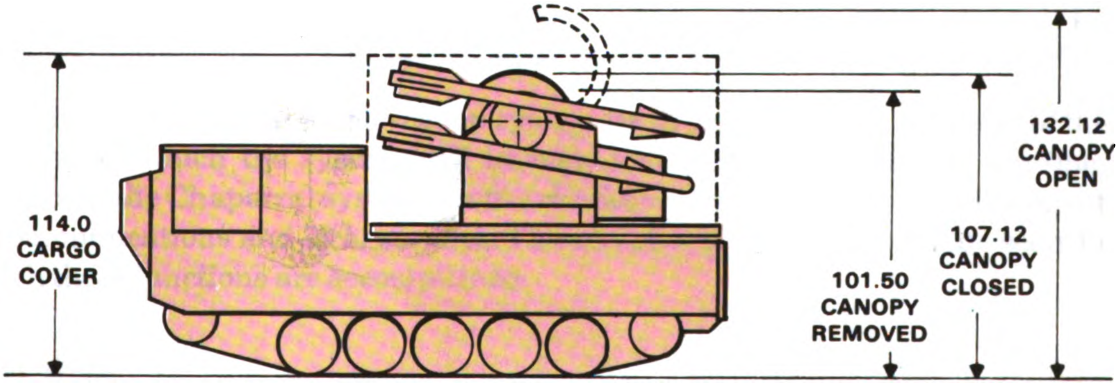
A winch holding 200 feet (61 meters) of ⅝-inch (1.34 cm) wire rope is mounted on the front of the vehicle. Maximum line pull of the winch is 20,000 pounds (9,072 kg) and it has a maximum line recovery speed of 15 feet per minute under full load.

Tabulated data for Carrier, Guided Missile Equipment, Self-propelled, M730, is listed in TM 9-1425-586-10.

DIMENSIONS



MOUNT ERECTED



MOUNT RETRACTED

VEHICLE: LENGTH 238.5, WIDTH 105.75, HEIGHT (CARGO COVER) 114.0

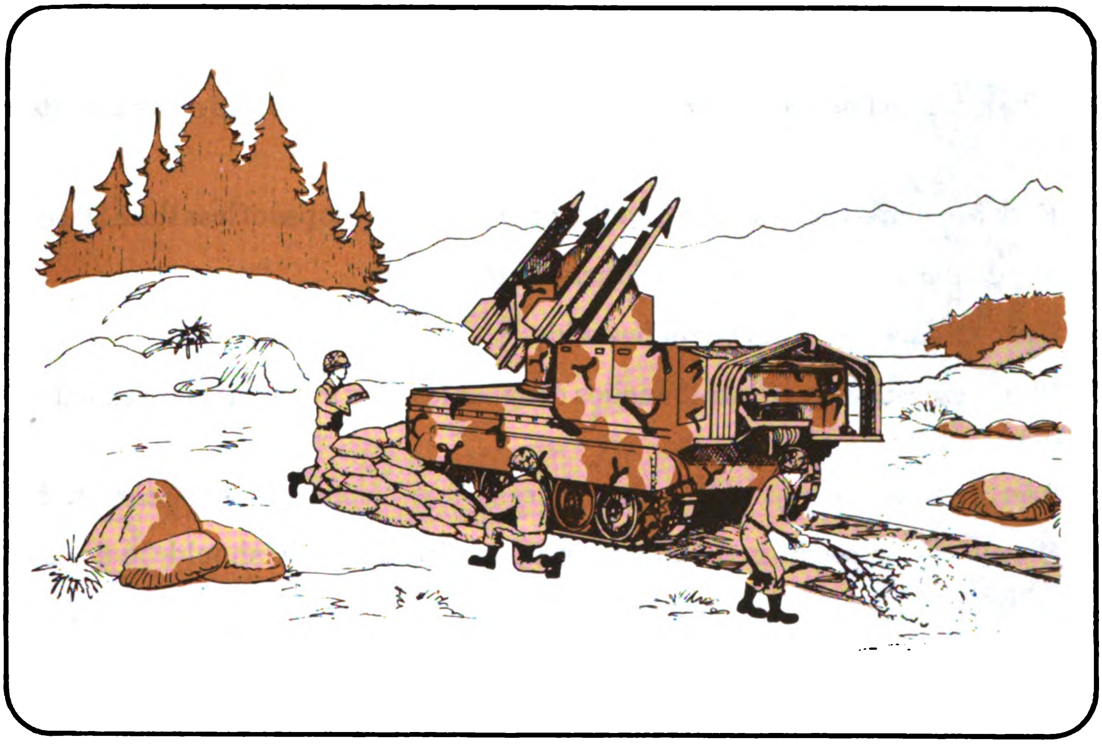
MISSILE LENGTH: 114.5

ERECTION TRAVEL: 22.38

Note. DIMENSIONS ARE IN INCHES.

CHAPTER 2

PREPARING FOR FIRING THE WEAPON



Preparing the Chaparral weapon system for firing starts with selection of the position on which the system will be emplaced, preparation of that position, emplacing the Chaparral system, prefire checks on the system, and establishment of communications and local security. This chapter discusses some of the ways in which these functions are accomplished.

RSOP

Reconnaissance, selection, and occupation of position (RSOP) is a method for rapid movement of Chaparral fire units from one defended area to a new area. The platoon leader must keep himself and his squad leaders informed of the current and anticipated future operations to effect timely RSOP. Position area, route, and critical time information usually come from the battery commander or from the C/V battalion S3, and serve as the basis for the RSOP. Procedures to be followed are generally outlined in FM 44-3 and TC 44-3-1.

FIRE UNIT POSITION REQUIREMENTS

Map positions for fire units assigned by the order directing the move should be adhered to as closely as possible. Positions more than 100 meters from the assigned position may degrade the overall air defense.

The site must be accessible to the Chaparral. Routes into and out of the site may have—

- Forward slopes of less than 60 percent and/or side slopes of less than 30 percent.
- Vertical obstacles less than 24 inches high.
- Deep ditches less than 66 inches wide.
- Water crossing less than 40 inches deep, unless the swim kit is installed on the carrier.
- Terrain that will support a ground pressure of 7.5 pounds per square inch.
- Slopes not exceeding 10° at the weapon site. The site should be as level as possible.

Fields of view. Since the fire unit crew must see the target to detect and track it, the field of view from the weapon and observation posts should be clear.

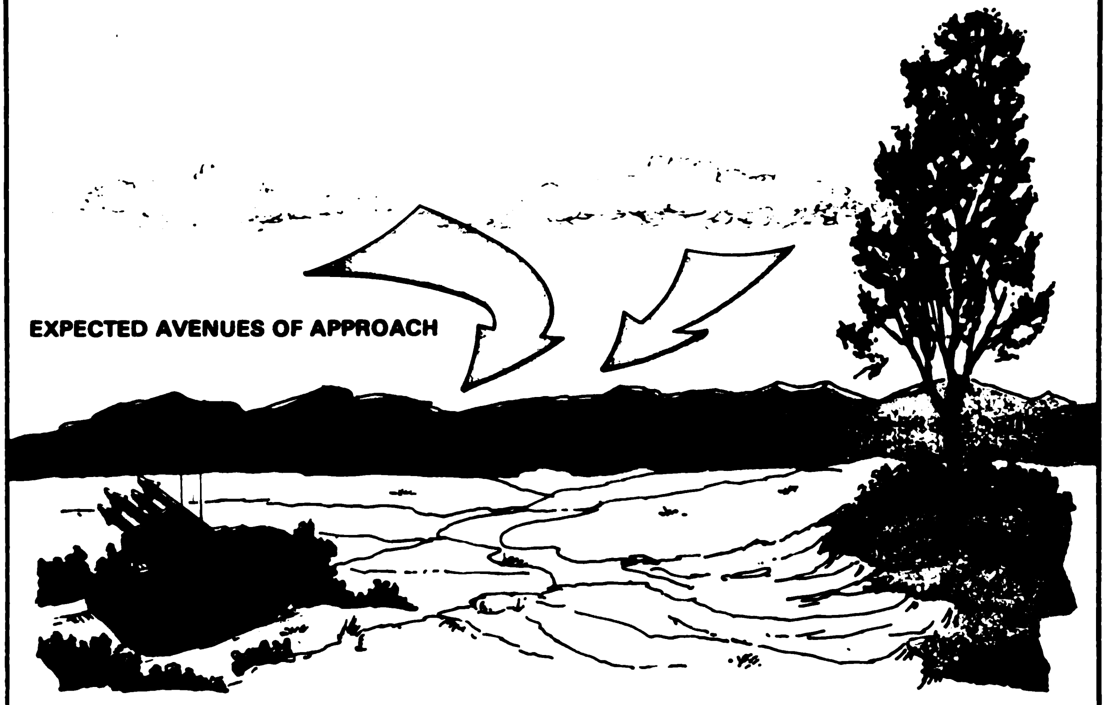
The forward observation post (OP) should have a good view along the expected avenues of approach for at least 2.5 kilometers.

The squad leader's command post (CP) should be placed so as to have a field of view along the expected avenues of target approach that includes the weapon and the gunner's field of view. This is to provide early acquisition and identification of targets by the squad leader. Identification normally occurs at 2-3 km with the naked eye. Some targets will be engaged "going away." A clear view to the rear will allow the squad leader to see the intercept and assess the damage.

The gunner in the weapon mount should have a clear field of view of at least 2.5 km in the expected avenue of approach. A view of 8-15 km is desirable, terrain and tactical situation permitting. His view should not be blocked by a rise or tree line over 15 meters high within 50 meters of the weapon.

POSTS

A Chaparral position has three posts.



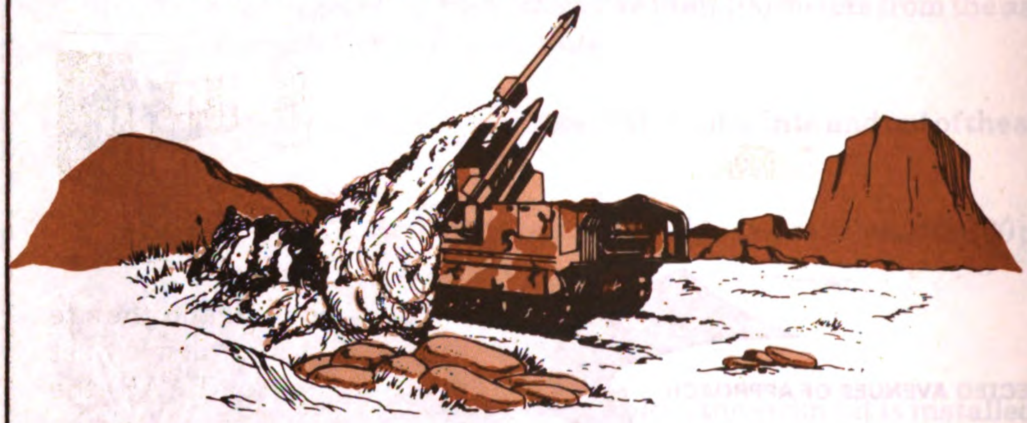
Weapon system. The Chaparral should be at the site selected during the RSOP.

Command post. The squad leader's CP should be as close to the rear of the weapon as safety from the blast effects of the missile will allow. It should be selected to have the same field of view as the gunner. The squad leader must see the target being tracked by the gunner to be sure it is the target that he has selected.

Forward observation post. The OP should be on commanding terrain forward of the weapon to have a maximum field of view in the direction of expected target approach. The communications wire is ¼ mile (0.4 km) long, so the OP can be no further than that from the weapon.

SAFETY

Personnel and equipment safety. The blast and noise of missile launch cause safety hazards that affect site selection—

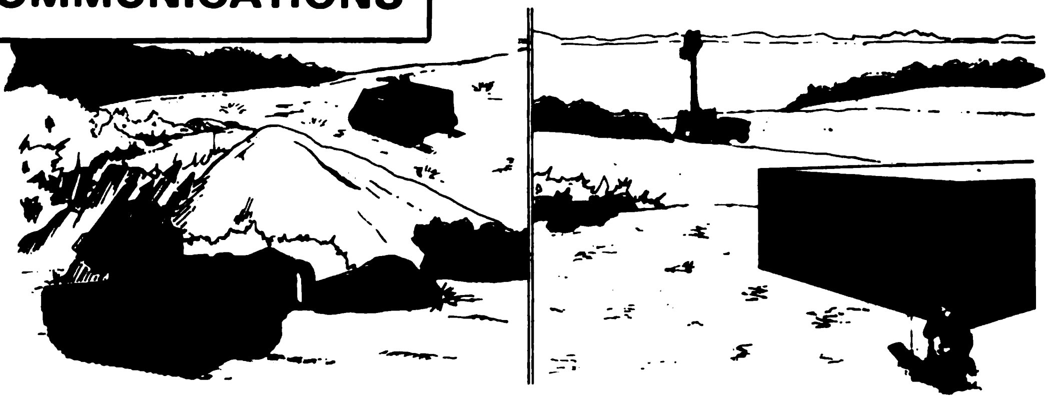


- The missile exhaust striking stones, branches, or other debris can cause these objects to become missiles that fly to about 200 feet (61 meters). Unprotected personnel should not be closer than 200 feet from the system.
- The noise of missile launch can harm the ears of personnel less than 200 feet from the system. (The gunner is protected from noise and exhaust by the gunner's compartment.)
- Large vertical obstructions within 50 feet or less of the weapon can deflect debris and missile blast into the weapon system and cause damage.
- Dry grass and material near the system can be set on fire by the missile exhaust.

SURVIVABILITY

The Chaparral must survive if it is to accomplish its mission. Sites should be selected with this in mind. The missile vapor trail can reveal the position of the Chaparral when the missile is launched. The silhouette of the Chaparral is hard to hide. If the enemy can see or find the Chaparral, he can destroy it by mortar, artillery, and aerial attack. Sites that place a ground rise or tree line between the weapon and the enemy will help keep the enemy from finding the weapon. The weapon should not be placed within 50 meters of a rise or tree line about 15 meters in height to preserve a good field of view. The OP and CP should be placed to make the best use of natural cover. All positions can be improved by digging and using natural camouflage materials. Refer to TC 44-1-1 and TC 44-1-2 for more survival information.

COMMUNICATIONS

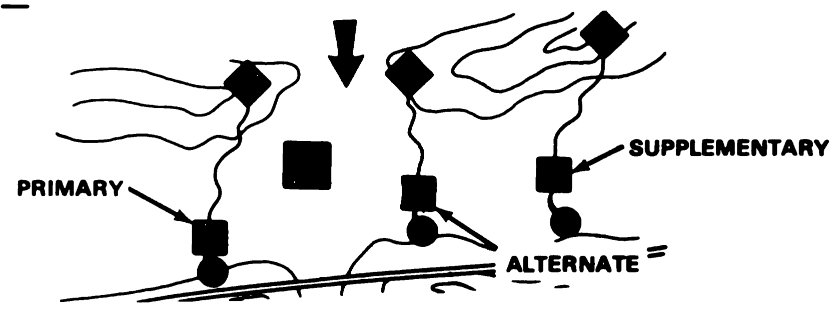


When radio contact with the platoon leader can not be made, the site should normally not be used. When the target alert data display set (TADDS) can not receive from the forward area alerting radar (FAAR), the site should normally not be used. Hills and large buildings may block the line-of-sight communications needed for the radios.

Within the squad, telephones will be used. If wire cannot be laid, hand signals may suffice.

POSITION TYPES

Positions selected for Chaparral squads defending a fixed asset are classified as—



Primary. This is the best site available in the designated area for the fire unit to do its job.

Alternate. This is another site where the fire unit can do its job. It is occupied when the primary site is compromised.

Supplementary. This is a site for doing a special job that cannot be done at the primary site.

Platoon headquarters. The platoon leader selects the platoon headquarters site. The site chosen is—

- Centrally located with short lines of communication to the fire units when wire communications are used and the terrain permits, or
- Collocated with one of the fire units for radio backup and increased local security.

After approving the fire unit sites, the platoon leader informs the battery commander or the S3, as appropriate, of the location of the fire units and the platoon headquarters.

OCCUPATION

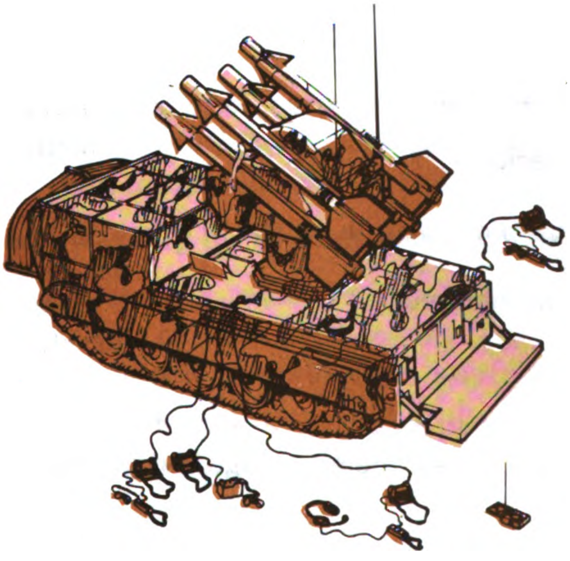
Plans. The platoon leader must plan for occupation of sites as they are selected. This plan must be in agreement with the plan of the battery. The plan must cover—

- The time that the platoon must be in operation at the new site.
- Primary and alternate routes and travel times from the old site to the new site.
- Communications during the move.
- Security during the move and occupation.

Orders. Once the plan is formed, orders are issued to carry it out. The move should be made as quickly as possible to reduce the time that the fire unit is out of action. Each fire unit should report ready for action within 15 minutes after arriving at the new site. When all units have reported ready, the platoon leader will report the platoon as ready for action.

EMPLACING THE WEAPON

Move the fire unit to the emplacement position. The position must meet the requirements previously discussed.



When the fire unit is parked in the selected position, the squad dismounts and starts preparing for action as required; i.e., removing the cab cover and/or windshield kit, unfolding the blast covers, and deploying equipment as directed in TM 9-1425-586-10 and the drills in chapter 8 of this manual.

Upon arrival at the new site the Chaparral system is prepared for firing. Although some of the following phases are accomplished simultaneously by different personnel, each phase must be completed.

Establish local security. Local security and defense against ground attack by infiltrators, guerrillas, or partisans are the responsibility of all Chaparral commanders. The Chaparral fire units may be up to 2 km apart and friendly troops may or may not be near. In any event, they will not be within 200 feet (61 meters) of the fire unit. Therefore, the initial responsibility for defense against ground attack rests with the squad leader and his four men. They have their individual weapons.

At least one man must scan the surrounding ground at all times to detect any threatening activity. This duty will be passed between squad members as their other duties permit.

Emplace the system. The Chaparral system is emplaced and prepared for firing in accordance with the emplacement crew drill in chapter 8.

Emplacement includes:

- Locate and equip CP and OP.
- Prepare system.
- Lay communications wire.
- Perform prefire checks.
- Orient TADDS and plot position on it.
- Prepare missiles as required.

Construct prone positions for crew members. Prone positions will afford some protection for crew members against ground attack.

Improve position. The weapon and crew positions should be improved as soon as men can be spared from the job of getting the weapon ready to fire. This should continue as long as the weapon is at the site.

Sandbag and earth revetments can be built around the weapon up to the height of the launching station deck. The tracks made by men and vehicles must be erased.

Prepare alternate and supplementary positions as time allows. An alternate position must be selected so that the fire unit can move to it quickly whenever its primary position is compromised.

Establish communications. Communications security procedures are enforced at all times. Networks include:

Radio.

The platoon headquarters receives early warning alerting information from the C/V AD coordinating officer over the one-way battalion early warning net and relays pertinent information to the squads over the platoon net.

Squads receive early warning by TADDS from the FAAR.

The platoon headquarters has radio communications with its battery, its squads, and the defended unit or asset. The squads have radio communication with each other and the platoon headquarters, and are able to monitor the defended unit or asset radio net.

Telephone.

Telephone communications may be set up within the platoon whenever it is felt that the sites will be used long enough and the tactical situation permits. The platoon headquarters has a radio operator to handle communications.

CHAPTER 3

ENGAGING AIRCRAFT

The mission of Chaparral is to protect critical assets, troops, or installations from low-altitude air attack. This means that each aircraft in the airspace must be detected and, if identified as hostile, destroyed or deterred before it can attack. This chapter discusses how it is done.

[illegible]

Chaparral squads are commanded and controlled by the platoon leader, assisted by the platoon sergeant. The platoon leader furnishes to the squads the DEFCON, air defense warning, air defense weapon control status, and hostile criteria in effect. These are discussed in FM 44-3. Whenever any of this information is changed and is sent to the squads by radio or telephone, a proper interrogation and response are required.

[illegible]

The squad leader, as the fire unit tactical commander, is responsible for the decision to engage. He must make the decision in accordance with rules contained in the unit SOP.

The squad leader is responsible for:

- Identification of the target as a friend or a foe.
- Selection of the specific target to be fired at.
- Designation of the type of missile to be used.
- Selection of the method of fire to be used.

RULES OF ENGAGEMENT

Rules of engagement prescribed by the region air defense commander are published in the unit SOP. They control fires at friendly aircraft while maintaining the level of defense required. The rules usually provide that—

- The right of self-defense against air and ground attack is never denied in peace or war.
- During conditions short of war, engagements are conducted only in self-defense or as ordered by designated commanders.
- During wartime, aircraft will be fired on in accordance with the weapons control status and when visually identified as hostile as specified in the hostile criteria in the SOP.

WEAPONS CONTROL STATUS

The weapons control status sets the degree of control over the fires of the Chaparral.

Weapons Free - Fire at any aircraft not positively identified as friendly. Unknowns may be fired on in this status.

Weapons Tight - Fire only at aircraft positively identified as foe according to the hostile criteria in the SOP. This should be the normal status in wartime.

Weapons Hold - Do not fire except in self-defense. This status may be set in an area in terms of time and aircraft type. For example: "Weapons Hold Rotary Wing." The hold is for the named aircraft only.

FIRE COORDINATION

Coordination of fire in a Chaparral defense is achieved by—

- Proper defense design.
- Assigning each squad one primary and one or more secondary sectors of fire. Targets in the primary sector have priority.

- Personal orders and SOP.
- Control of fires is accomplished by the platoon leader to:
    - Regulate multiple engagement of the same target.
    - Conserve ammunition.
    - Shift primary and secondary sectors of fire.
- Weapons control status, changes in hostile criteria, and early warning of aircraft approaching the squads.

[illegible]

Observer procedures. The first step in a Chaparral engagement is visual detection of the target. This may be done by any one in the squad. In every case the target location must be made known to the squad leader and gunner. The range at which aircraft may be detected varies with the conditions under which detection is tried. Some of these conditions are—

- Terrain masking. Since Chaparral observers are on the ground, the local terrain will influence the distance at which low-altitude aircraft will unmask, i.e., not be hidden behind a hill or other feature. Terrain mask should be kept in mind when selecting a site.
- Target characteristics. The main features of an aircraft that affect detection range are—

Size. The larger the target, the farther away it can be detected. Apparent aircraft size varies with the type of aircraft and the aspect from which it is viewed. A jet fighter flying a course directly toward or away from an observer shows a small profile and can get quite close to the observer before it is detected. The same aircraft on a crossing course has a much larger profile and thus can be detected at a greater range.

Color. The color of an aircraft affects the degree with which the aircraft contrasts with the background against which it must be seen. The background in the direction from which targets are expected to come should be considered in choosing observer positions. Many jet aircraft leave a dark smoke trail that can be used as an aid in detection at long ranges.

Speed. Target speed affects the visual detection of aircraft. Detection range gets less as target speed increases.

Altitude and heading. Targets flying at altitudes of 150 to 1,200 feet (46.7 to 366 meters) are detected at longer ranges than those higher or lower.

Meteorological visibility. Rain, snow, dust, fog, smoke and haze tend to reduce visibility and so tend to reduce the range of visual detection of aircraft.

Visual acuity. Observers are required to detect, recognize, and identify small objects at long ranges. Therefore, they must have good visual acuity. Binoculars have little effect in detection because they have narrow fields of view. This increases the time required to search a given area of space. Binoculars may help to identify a target.

Search sector size. Search sectors should be as small as possible and still have good coverage to both sides of the expected avenues of target approach. When observers are alerted to an approaching target, the search sector should be reduced and concentrated in the direction of the expected approach.

Observer fatique. Long periods of observer duty may degrade performance due to fatique. Observer duties should be rotated as often as possible.

SEARCH TECHNIQUES

Two ways are used to look for aircraft:

- One for flat terrain.
- One for hilly terrain.

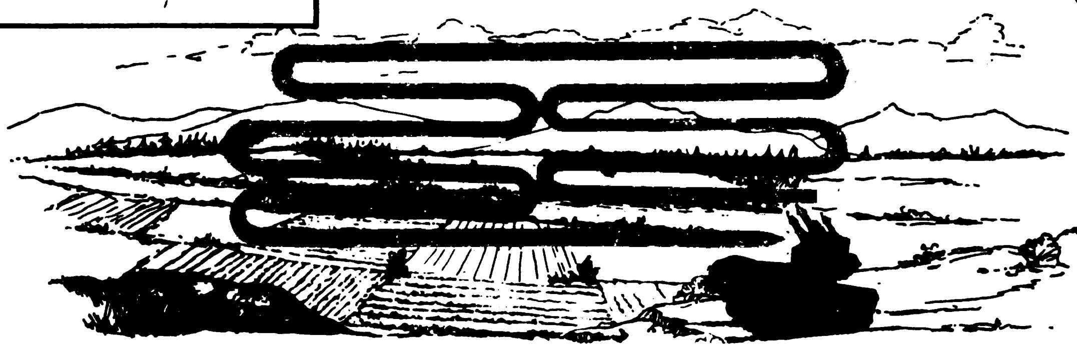
In both, the observer should:

- Frequently focus his eyes on a distant object, such as a cloud or terrain feature. Otherwise, his eyes will tend to relax and distant objects become blurred.

- When searching near the sun, block out the sun with an extended thumb. Looking directly at the sun, without shielding the eyes,can cause blindness for a few seconds.

- Keep his eyes on the aircraft once he sees it. If he has to look away from it, he notes the direction in which it is heading. He moves his eyes away from it when it is near some object, such as a cloud, that will guide his eyes back to it.

FLAT TERRAIN

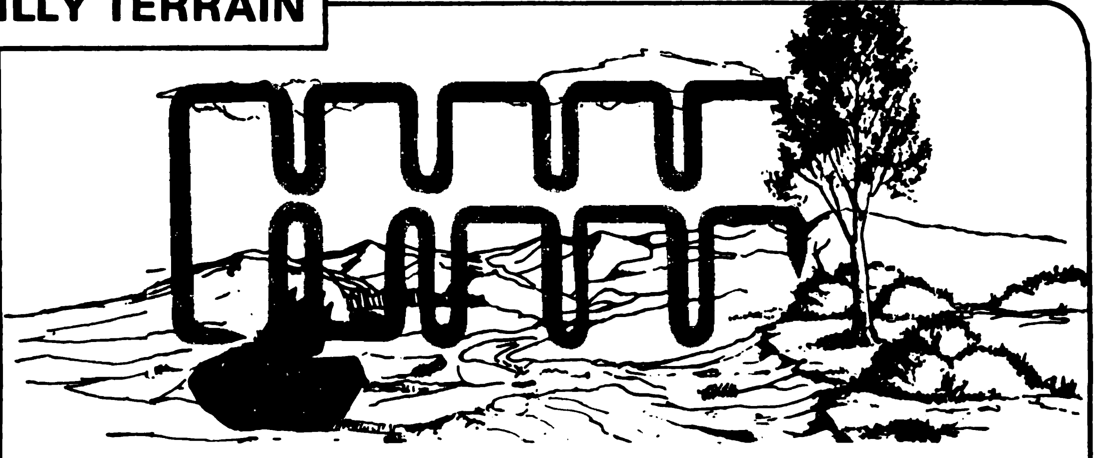


In flat terrain, the observer searches the horizon to about 20° (356ṁ) above the horizon by moving his eyes in short movements across the sky, working his way up and across.

Continues the scan pattern below the horizon to detect aircraft flying nap-of-the-earth.

More detail is registered this way than with a continuous scan of the horizon.

HILLY TERRAIN



In hilly terrain the observer searches the sky using the horizon as a starting point and prominent terrain features as points of reference. He moves his eyes in short movements up the sky, then back down, continuing this movement across the terrain.

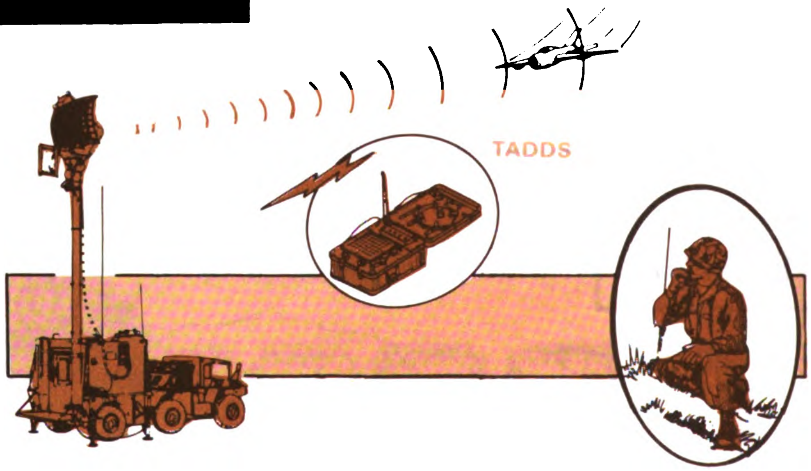
He scans in the same pattern below the horizon to detect aircraft flying nap-of-the-earth.

SOME THINGS TO LOOK FOR

Many aircraft have tell-tale signatures which can lead to early detection. Chaparral squads should look for such things as:

- Sun reflection from aircraft canopies or cockpit windows.
- Blade flash from rotating helicopter blades.
- Smoke or vapor trails from jet aircraft and missiles or rockets fired from aircraft.
- Dust or excessive movement of tree tops and bushes in a particular area.
- Noise from helicopter blades or from jets breaking the sound barrier.

ALERT WARNING



A Chaparral squad may be warned of an approaching aircraft by the battalion early warning net (relayed by plt hq), the forward area alerting radar (FAAR)/target alert data display set (TADDS) system or other warning means, or it may visually detect the target without prior warning. Warning of the approach of an aircraft increases the chances of successfully engaging it.

Alert warning will usually give the general location of the aircraft and a tentative identification.

Operation and use of the FAAR and TADDS are contained in FM 44-6, Procedures and Drills for Forward Area Alerting Radar (FAAR) and Target Alert Data Display Set (TADDS).

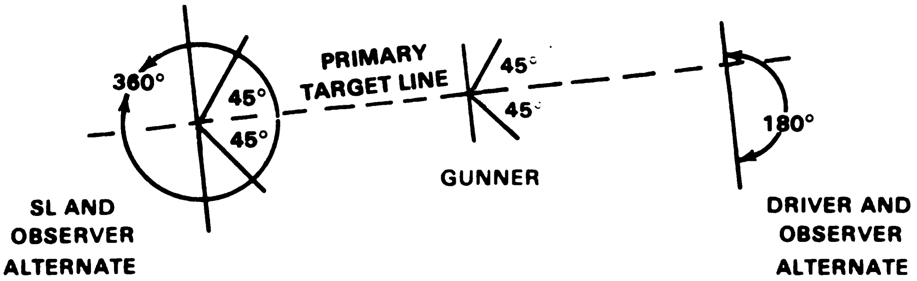
SEARCH SECTORS

When the Chaparral squad occupies tactical positions, squad members are assigned search sectors by pairs. This allows one member to be searching for aerial targets while his partner rests his eyes and provides ground security. They take turns searching.

Search sectors are arranged to provide all-around coverage of the entire area and overlapping coverage of the assigned sector of fire and likely approach routes.

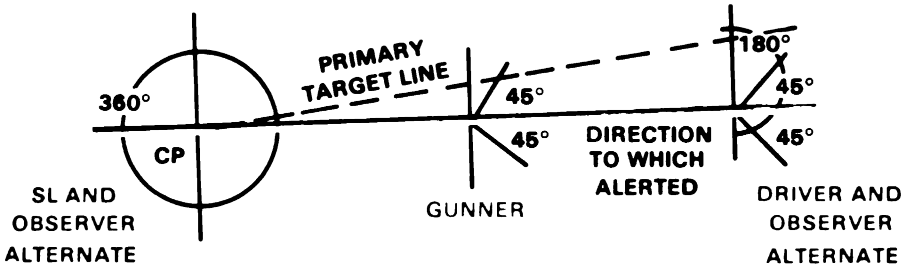
When an alert warning is received, all squad members shift search emphasis to the azimuth of approach (with frequent all-around scans) until one member detects the target.

NOT ALERTED



When not alerted to the approach of an aircraft, one crewman at the OP will search a 180° sector. He will place emphasis on a 90° sector, 45° to each side of the primary target line. One crewman at the CP will search in a complete circle. The gunner will not act as an observer but will have the Chaparral system ready for action at all times.

ALERTED


PRIMARY TARGET LINE
360°
CP
SL AND OBSERVER ALTERNATE
45°
45°
GUNNER
DIRECTION TO WHICH ALERTED
180°
45°
45°
DRIVER AND OBSERVER ALTERNATE

When alerted to the approach of an aircraft, the whole crew will act as observers. The squad leader, gunner, and one crewman at the OP will search a sector 45° to either side of the approach azimuth. The other crewman at the OP will continue to search the 180° sector and the crewman at the CP will continue to search the 360° complete circle. This will cause rapid detection of the aircraft to which alerted, and yet not allow any other aircraft to sneak in undetected.

IDENTIFICATION

Firing of a Chaparral missile at an aircraft must be based on identification of the aircraft as a HOSTILE (or under certain conditions as an UNKNOWN). This identification is based on visual inspection of the aircraft and the application of specific hostile criteria. The responsibility for aircraft identification rests with the squad leader. In every case the identification must be completed before the squad leader can give a command to engage.

AIRCRAFT IDENTIFICATION

After an aircraft has been detected, it must be identified as friendly or hostile. This identification must be positive. There is no room for error.

If the aircraft belongs to the enemy, it must be destroyed.

If the aircraft belongs to us or one of our allies, it is a friendly aircraft and must not be destroyed. We need them.

Recognition of the aircraft by name or country of manufacture is a start, but it is not conclusive. For instance, the Mirage III/V is made in France. However, it is in service in 23 countries in Europe, Middle East, Africa, and South America. Other aircraft are similarly spread throughout the world, including some made in the United States of America.

HOSTILE CRITERIA

Target identification as hostile must be based on visual inspection of the target and its assessment against specific hostile criteria. The exact criteria in use may vary with the tactical situation, from command to command, and in terms of time. For example, the SOP may classify as hostile those aircraft that are:

Attacking friendly elements. Any aircraft actively attacking the fire unit or friendly troops, areas, or installations may be identified as hostile.

Responding improperly to electronic IFF interrogation. A TADDS unknown disc is based on the failure of an aircraft to properly respond to the FAAR electronic IFF interrogation. The squad leader may accept a TADDS "unknown" (foe) disc as a first assumption of hostility. He must then successfully apply at least one more hostile criterion based on visual observation of the aircraft before making a final identification of the aircraft as a hostile.

Performing any of the following acts over friendly troops or territory without prior coordination.

- Discharging smoke or spray.
- Dropping flares.
- Engaging in mine-laying operations.
- Discharging parachutists or unloading troops in excess of normal aircraft crew.

- Dropping electronic countermeasures such as chaff, reflectors, sensors, etc. Due to the possibility of a communications lag, wherein "prior coordination" to squad level may not be accomplished prior to friendly aircraft doing these acts, the squad leader should apply this criterion with care. Generally, at least one additional criterion should successfully be applied before an identification as hostile is made.

Unauthorized or improper entry into an area designated as restricted or prohibited. Care should be exercised in the application of this criterion to avoid identifying as hostile a friendly aircraft that has been damaged and is returning to the rear of our lines or has inadvertently strayed into the restricted area due to a navigation error.

Operating at prohibited speeds, altitudes, or in prohibited directions. The determination of aircraft speed and altitude by ground observers is difficult. Extreme care should be exercised in applying this criterion.

Bearing the military marking or having the configuration of an aircraft employed by a known enemy nation. This is the criterion most likely to be used by the Chaparral squad leader and probably the most difficult to apply. Application of this criterion must be based on visual inspection of the aircraft and requires the squad leader to be expert in the field of visual aircraft recognition. Since aircraft markings are not usually visible at long ranges, most identifications must be based on recognition of the physical features of the aircraft. To eliminate any element of doubt the squad leader must be capable of recognizing friendly as well as enemy aircraft. Also, since all Chaparral squad members are potential squad leaders, all squad members must be expert in the field of aircraft recognition. (For a detailed discussion of aircraft recognition refer to TC 44-30.)

METHOD OF ENGAGEMENT

The method used to engage aircraft depends upon how many there are. A multiple target raid is a raid by two or more aircraft flying the same course, at the same speed, less than 1,000 meters apart. All other raids are single target raids.

All single target raids are engaged using a SHOOT-LOOK-SHOOT technique of fire. This method is the firing of a missile (SHOOT) as soon as the requirements for an engagement are met. Then an evaluation (LOOK) of the performance of the missile to see if it hits. A second (SHOOT) missile is fired if the first does not destroy the target.

If a missile leaves the launch rail and appears to be on a guided course toward the target, the missile is assessed as successful and another is not fired until a kill evaluation can be made.

If the missile fails to leave the launch rail, or appears to have failed to achieve guided flight, it is assessed as unsuccessful and a command to fire another missile is given.

If an otherwise successful missile fails to kill the target, a command to fire another missile is given.

When using the SHOOT-LOOK-SHOOT method of fire, each missile fired must be preceded by a fire command and meet the gunner's requirements for launching.

Upon firing the first missile, the gunner regains visual tracking and IR tone as quickly as possible for the firing of the second missile.

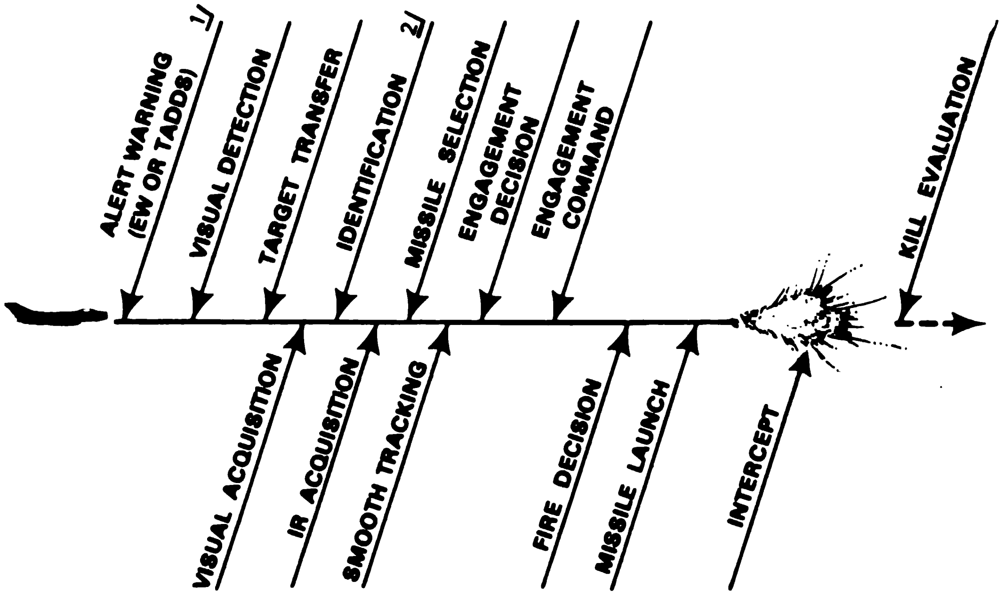
The gunner does not watch the flight of the missile. The squad leader observes the flight of the missile, makes the kill evaluation, and commands the launch of more missiles, if needed.

MULTIPLE AIRCRAFT RAIDS

Multiple aircraft raids are engaged using a SHOOT-NEW TARGET-SHOOT technique of fire. This requires the launching of as many missiles as possible at successive aircraft in the raid. The squad leader gives the order in which aircraft are to be engaged; e.g., FRONT-TO-REAR or LEFT-TO-RIGHT. The gunner will engage aircraft in that order, firing one missile at each aircraft as fast as possible. A command is not required for each missile after the first and no kill evaluation is made between launches. Each launch must still meet the requirements for engagement.

CONDUCTING THE ENGAGEMENT

The engagement of an aircraft by a Chaparral squad using either type of missile consists of a sequence of events that begins with the detection of an aircraft and ends with its destruction. The major events in the 10- to 20-second sequence are shown in the following illustration.



1. May or may not be available.
2. May occur at any time after visual detection and before engagement order.

ENGAGEMENT PROCEDURES

The exact procedures will vary slightly from situation to situation but will, in general, be as follows:

Alert warning. An alert warning of approaching aircraft may be received over the—

- C/V battalion ADA early warning net by the platoon leader. He relays pertinent information to the squads over the platoon command net.
- FAAR/TADDS system by the platoon leader and the squads.
- Radio from the supported asset or other nearby unit.

- Intrasquad communication system from a squad member who detects the aircraft.

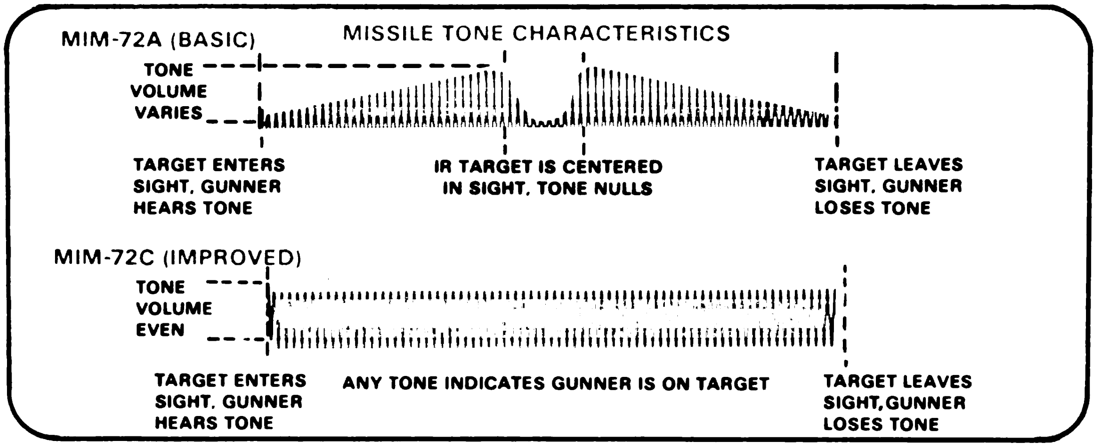
When an alert warning is received by the squad leader, he repeats it over the intercom. All squad members search the 90° sector surrounding the announced approach direction, with an occasional 360° search for other aircraft that may approach from another direction.

Visual detection. The squad member first detecting a target announces, TARGET, over the intercom, followed by a location statement. This includes clock azimuth, altitude in terms of high or low, and if a multiple target, the words, MULTIPLE TARGET.

Target transfer. Upon hearing the detection report the squad leader starts visual search at the azimuth announced for the target. The squad leader talks with the observer as necessary until he has located the target and then announces, CONTACT. The observer then returns to searching his assigned sector for other aircraft.

Visual acquisition. Upon hearing the detection report the gunner slews the mount to the azimuth of approach and, upon locating the target, begins visual track of the target. The gunner does not speak on the intercom until he is spoken to by the squad leader. The squad leader repeats the target location until the gunner has acquired it in his sight and says, CONTACT. If a multiple target, the squad leader specifies which target will be engaged first.

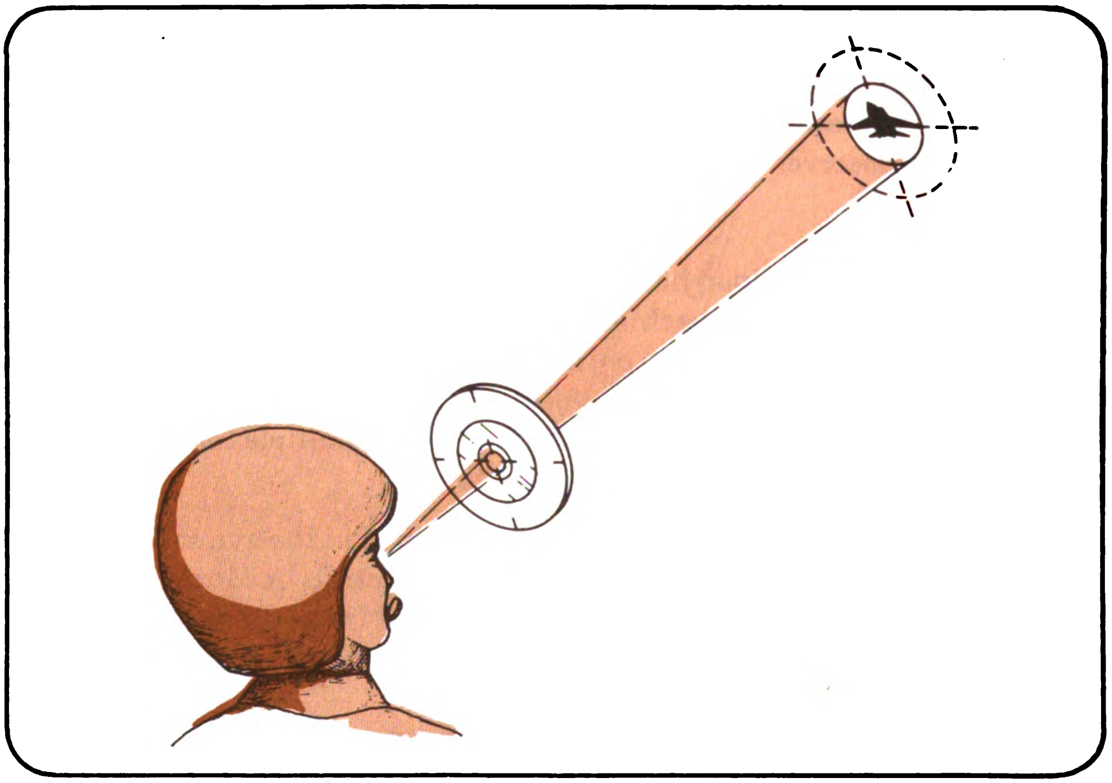
IR acquisition. After the target has been located in the gunner's sight, the gunner attempts IR acquisition. He adjusts the hand controls until an IR tone signal is heard, indicating IR acquisition. He maintains the IR source within the inner circle of the sight reticle. Upon hearing the IR tone, the gunner announces, TONE, over the intercom.


MISSILE TONE CHARACTERISTICS
MIM-72A (BASIC)
TONE VOLUME VARIES
TARGET ENTERS SIGHT, GUNNER HEARS TONE
IR TARGET IS CENTERED IN SIGHT, TONE NULLS
TARGET LEAVES SIGHT, GUNNER LOSES TONE
MIM-72C (IMPROVED)
TONE VOLUME EVEN
TARGET ENTERS SIGHT, GUNNER HEARS TONE
ANY TONE INDICATES GUNNER IS ON TARGET
TARGET LEAVES SIGHT, GUNNER LOSES TONE

When the improved missile seeker is tracking the target, a steady continuous tone will be heard in the gunner's earphone.

When the basic missile seeker is tracking the target, a tone of varying amplitude will be heard. The tone increases in amplitude as the point of tracking nears the center of the sight reticle but nulls to near nothing when the seeker is centered on the target's IR source.

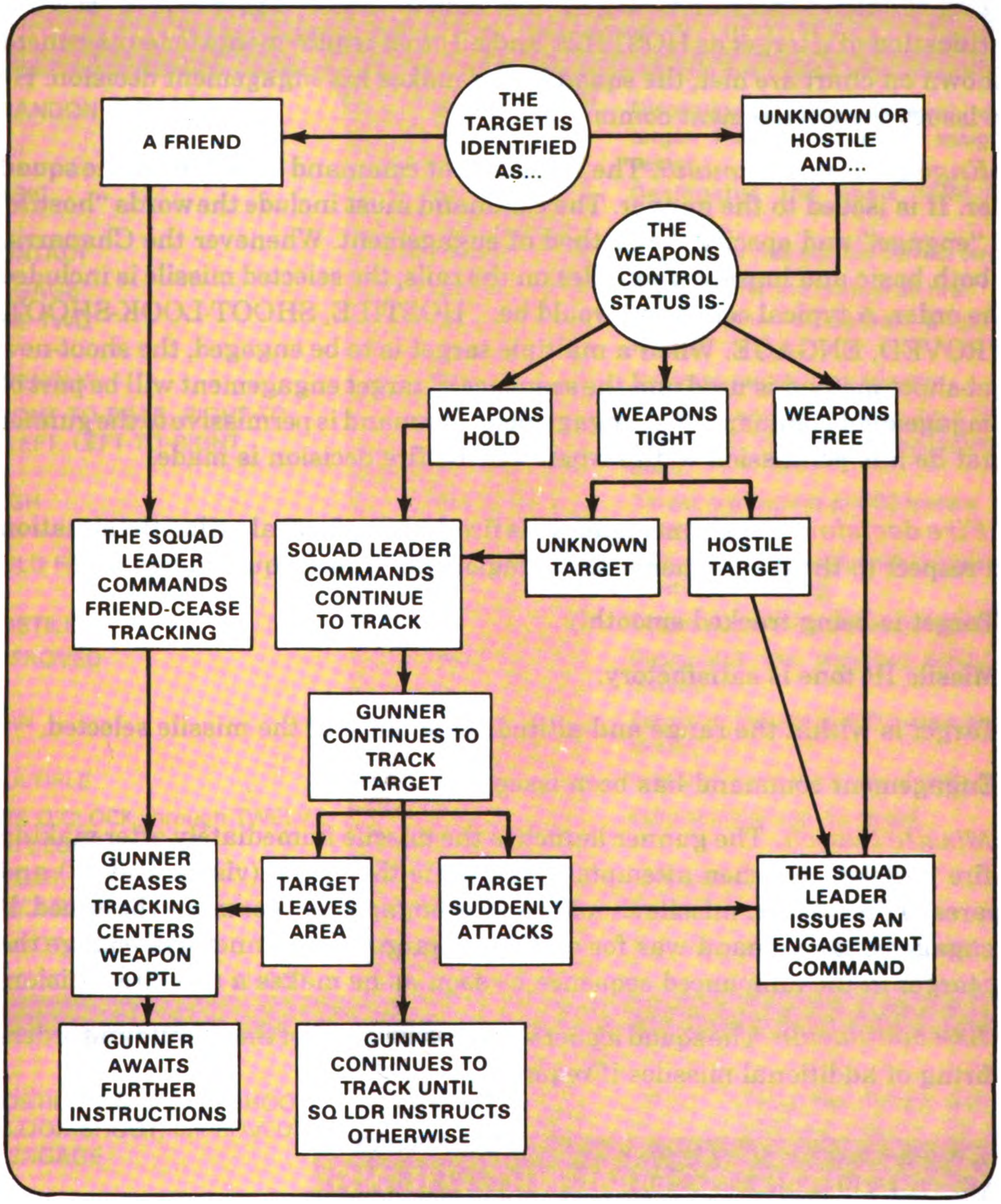
If a missile tone is received, the target is considered within the launch envelope. With the improved missile, any tone is a good tone. With the basic missile, the gunner tracks the point that gives the greatest tone amplitude.



Smooth tracking. The gunner tracks the target smoothly while awaiting the engagement command from the squad leader. Smooth tracking is defined as being able to hold the target within the inner circle more than half the time.

Identification. Target identification is made by the squad leader as soon as possible by the application of the prescribed hostile criteria.

Note: The target identification decision may be changed at any point in the engagement.


THE TARGET IS IDENTIFIED AS...
A FRIEND
UNKNOWN OR HOSTILE AND...
THE WEAPONS CONTROL STATUS IS-
WEAPONS HOLD
WEAPONS TIGHT
WEAPONS FREE
THE SQUAD LEADER COMMANDS FRIEND-CEASE TRACKING
SQUAD LEADER COMMANDS CONTINUE TO TRACK
UNKNOWN TARGET
HOSTILE TARGET
GUNNER CONTINUES TO TRACK TARGET
GUNNER CEASES TRACKING CENTERS WEAPON TO PTL
TARGET LEAVES AREA
TARGET SUDDENLY ATTACKS
THE SQUAD LEADER ISSUES AN ENGAGEMENT COMMAND
GUNNER AWAITS FURTHER INSTRUCTIONS
GUNNER CONTINUES TO TRACK UNTIL SQ LDR INSTRUCTS OTHERWISE

Missile selection. The launch rails may be loaded with either basic or improved missiles or both. If they are loaded with both, the squad leader can select either type missile for the engagement and must include his selection in the engagement command. An improved missile should be selected to engage an inbound jet or if there are flares near the target. A basic missile can be selected for all other engagements.

Engagement decision. When the squad leader has made a positive identification of a target as HOSTILE, and all other requirements for engagement as shown on chart are met, the squad leader makes his engagement decision. He then issues the engagement command.

Engagement command. The engagement command is issued by the squad leader. It is issued to the gunner. The command must include the words "hostile" and "engage" and specify the method of engagement. Whenever the Chaparral has both basic and improved missiles on the rails, the selected missile is included in the order. A typical command would be: HOSTILE, SHOOT-LOOK-SHOOT, IMPROVED, ENGAGE. When a multiple target is to be engaged, the shoot-new target-shoot method is used and the sequence of target engagement will be part of the engagement command. The engagement command is permissive to the gunner in that he has permission to fire whenever his fire decision is made.

Fire decision. The gunner makes his fire decision by evaluating the situation with respect to the requirements for engagement. These requirements are:

- Target is being tracked smoothly.
- Missile IR tone is satisfactory.
- Target is within the range and altitude capability of the missile selected.
- Engagement command has been issued.

Missile launch. The gunner launches the missile immediately after making his fire decision. He then attempts to reacquire the target (visual and IR) and prepares to fire another missile should another engagement command be issued. If the engagement command was for a multiple target, the gunner will engage the next target in the announced sequence as soon as he makes a new fire decision.

Kill evaluation. The squad leader watches the flight of the missile and orders the firing of additional missiles if required.

ENGAGEMENT COMMUNICATIONS

Because the time for target engagement is limited, communications between squad members must be brief.

The words and phrases defined below, used singly or in combinations, are all of the words needed for an engagement. Talk will be held to the minimum required.

WORD PHASE	USED BY	DEFINITION ACTION
ABANDON TARGET		Discontinue tracking or searching for target. Resume search of assigned sector.
BASIC		Designates the basic MIM-72A missile.
CONTACT		SL/gunner has sighted correct target.
ENGAGE		Authority for the gunner to fire.
FIRE TWO		Tells gunner to launch a second missile.
FRIENDLY		Declares target to be friendly.
FRONT-TO-REAR, RIGHT-TO-LEFT, LEFT-TO-RIGHT		Order of engagement for MULTIPLE TARGETS. Part of the engagement order.
HIGH		Target is in excess of 400 meters above terrain.
HOLD FIRE		Gunner does not launch a missile. Continues tracking.
HOSTILE		Target visually identified as enemy.
IMPROVED		Designates the improved MIM-72C missile.
LOW		Target is less than 400 meters above terrain.
MULTIPLE		A raid of more than one aircraft.
ONE O'CLOCK through TWELVE O'CLOCK		Indicates direction to target.
ROGER		I understand
SAY AGAIN		Repeat last sentence.
SHOOT-LOOK-SHOOT		Technique for single aircraft raids.
SHOOT-NEW TARGET-SHOOT		Technique for multiple aircraft raids.

EXAMPLES

HOSTILE, 2 O'CLOCK, SHOOT-LOOK-SHOOT, IMPROVED, ENGAGE	Enemy aircraft at two o'clock. Gunner will fire, improved missile. SL will evaluate first missile, gunner will reacquire target and prepare to fire again if SL commands.
HOSTILE, 10 O'CLOCK SHOOT-NEW TARGET-SHOOT, BASIC, FRONT-TO-REAR, ENGAGE	Enemy aircraft at 10 o'clock. More than one. Gunner will fire at as many as possible, starting with the front aircraft.
TARGET, 2 O'CLOCK, LOW	Aircraft sighted at 2 o'clock, less than 400 meters altitude.
WARNING: AIRCRAFT, 2 O'CLOCK	Early warning information. Aircraft reported approaching from 2 o'clock.

POST-ENGAGEMENT ACTIONS

Upon completion of any combat action the squad will—

- Report the action to platoon headquarters, stating—
    - Results, i.e., aircraft hits, kills.
    - Personnel casualties.
    - Ready for combat status (if not ready, give reason).
    - Ammunition status.
    - Recommendation for moving to alternate site.
- Reload rails.
- Move to and emplace at an alternate site, if directed.
- Camouflage newly occupied position.
- Report location and ready status to platoon headquarters.

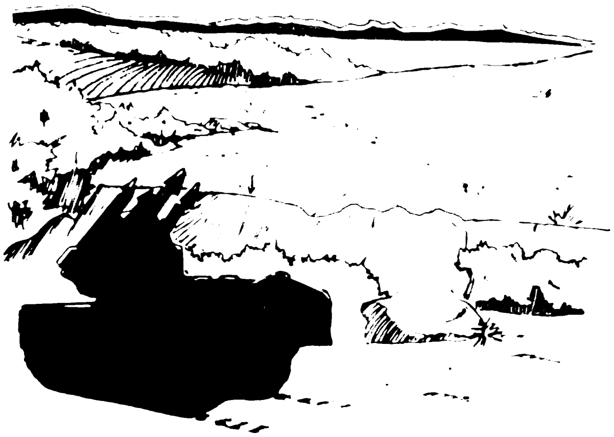
CHAPTER 4

SURVIVAL ON THE BATTLEFIELD

This chapter describes the techniques and procedures used to help the squad survive on the battlefield while still permitting the squad to accomplish its mission of protecting force assets from low-altitude air attack.

More information on survival may be found in TC 44-1-1 and TC 44-1-2.

AIR DEFENSE SUPPRESSION

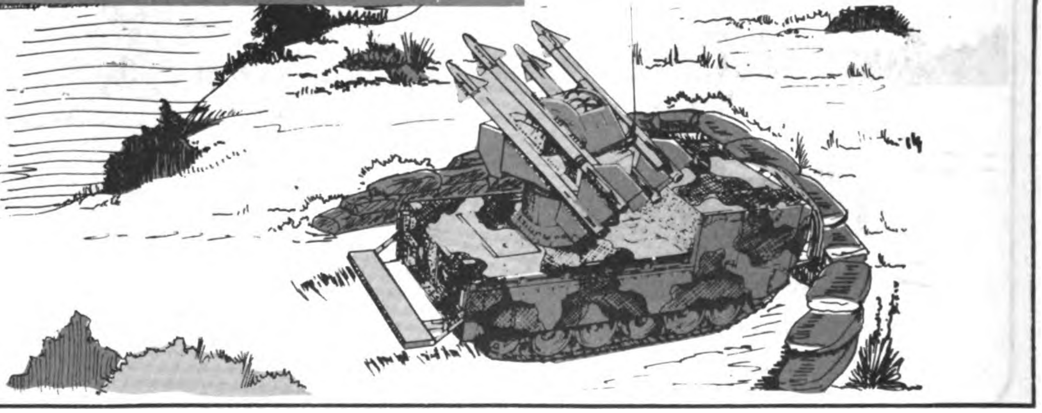


Air defense suppression is any effort to destroy or reduce the effectiveness of air defense weapons. Suppression of Chaparral and other forward area air defense weapons is of major importance to the enemy in his effort to gain and maintain control of the airspace over the battlefield. To attain this goal, the enemy dedicates both ground and air forces to the task of seeking out and destroying our air defense weapons.

The enemy will make a determined effort to suppress Chaparral. However, to attack and destroy a Chaparral the enemy must first find it. Then the enemy must deliver ordnance on or near the Chaparral.

Therefore, it is obvious that to survive on the battlefield, the Chaparral squad must first avoid detection and, if discovered, reduce the effectiveness of any ordnance used against it.

THINGS TO DO TO SURVIVE



To insure that Chaparral survives to do its job effectively:

Avoid detection by not revealing Chaparral's presence in the area until necessary.

Hide Chaparral's exact ***position*** by using care in position selection and then camouflaging the position.

Move Chaparral to ***alternate positions*** after the enemy has had a chance to locate its current position but move before he has had a chance to react.

Fortify each position to the ***maximum extent possible*** and provide crew protection from the effects of artillery and small arms fire.

Collectively, these measures not only enhance survivability but also allow the Chaparral squad to be prepared to deliver effective fire on enemy targets.

AVOID DETECTION

When a Chaparral squad opens fire against an enemy aircraft, the enemy can usually pinpoint the Chaparral's location and will attempt to suppress the weapon. However, up to the time of firing, the squad should use every means available to avoid detection by the enemy so that it can remain in its position and accomplish its mission.

Once the presence of Chaparral in an area has been detected, the enemy must still locate the exact positions to effectively deliver ordnance against them. The best way for the squad to avoid detection is to:

Carefully hide positions.

Keep the enemy from suspecting the squad is in the area until the squad opens fire.

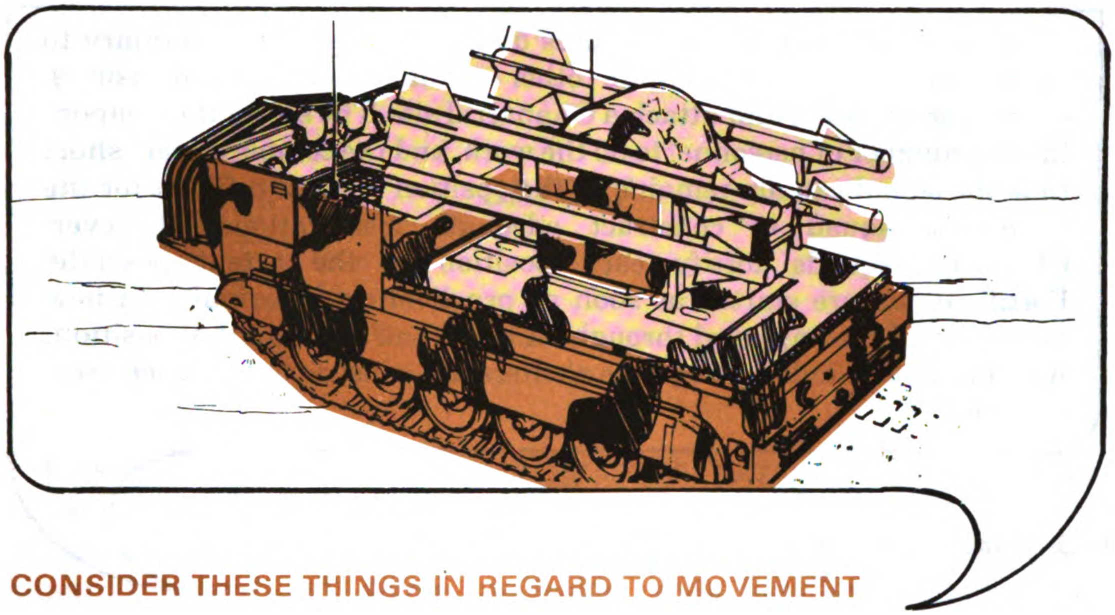
HIDE

Chaparral squads can hide their positions and avoid detection by:

- Selecting positions that are masked from enemy ground observation.
- Moving into positions during darkness or periods of poor visibility.
- Taking advantage of terrain to provide cover and concealment for the weapon.
- Using garnish netting, pattern painting, and natural materials to camouflage the positions.
- Blending equipment into the natural background.
- Erasing and covering tracks.
- Keeping the positions litter free.
- Enforcing noise and light discipline.
- Maintaining radio silence when possible and continuously practicing communications security.

MOVE

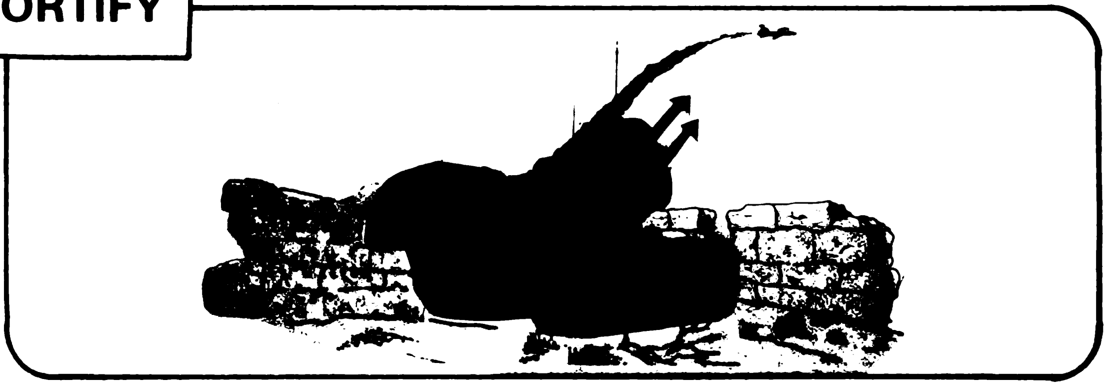
One of the best ways to keep the enemy confused as to the location of Chaparral is to move often. When changing positions, it is not necessary to move far. Alternate positions can be selected and occupied as required. The movement should be as rapid as possible so that the squad is again able to engage enemy targets.



CONSIDER THESE THINGS IN REGARD TO MOVEMENT

- Move often to keep enemy from knowing where you are.
- Need not move far.
- Move at night or when visibility is limited.
- Move quickly — get ready to fire.
- Seriously consider moving after:
    - Recent air reconnaissance of your area.
    - You have fired at an aircraft.
    - Your position has been fired on.
    - Position has been occupied from 4 to 6 hours.

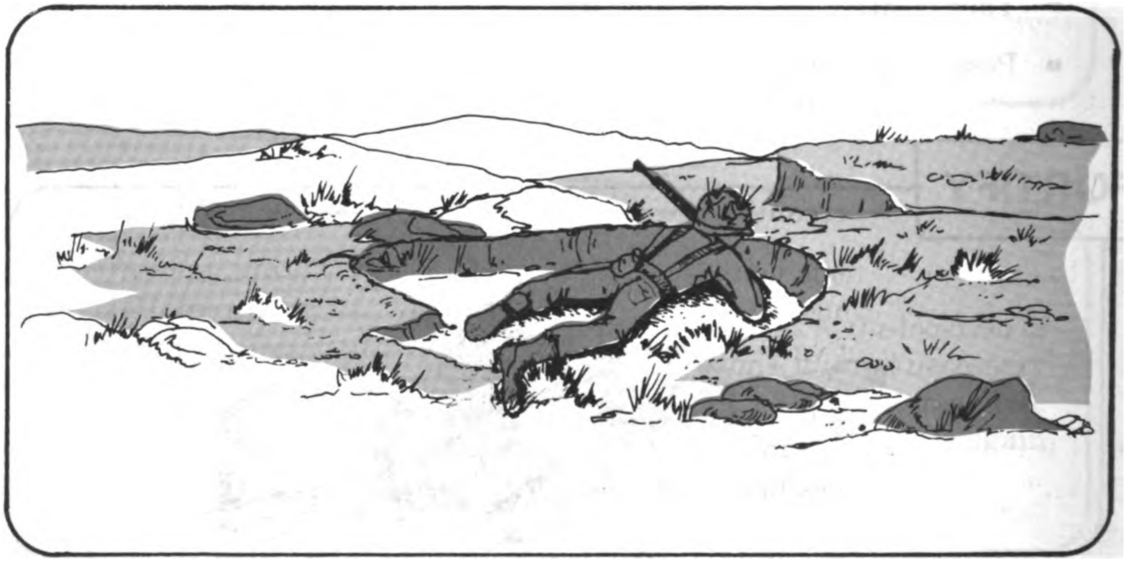
FORTIFY



Use of field fortification reduces damage to material and injury to squad members when, despite other countersuppression measures, enemy forces locate and attack a Chaparral site. The size of the weapon, limited number of personnel to do the work, and the comparatively short time the squad usually remains in the position make it difficult for the Chaparral squad to construct adequate fortifications. However, Chaparral squads fortify each position to the extent possible. Fortifications are started as soon as practical upon arrival in a new position and are improved throughout the squad's stay in that position. At a minimum, individual prone shelters are constructed for each crew member.

TO MAKE FORTIFYING A POSITION EASIER

- Select positions that are out of sight of enemy ground observation (e.g., the reverse slope of a hill rather than its crest). The same barrier to enemy observation also provides a barrier to enemy direct fires.
- Look for areas that provide natural protection. Terrain irregularities (such as defiles or mounds) provide initial fortifications that can be completed with sandbags or other fortifying materials.
- Obtain dirt to be used to construct fortifications at a distance from the position.
- Camouflage the fresh dirt to prevent pointing out the position. Field fortifications should complement camouflage, not degrade it.



CHAPTER 5

SAFETY

Personnel operating and maintaining the Chaparral missile system must be constantly aware of the hazards associated with the equipment and observe safe practices and procedures. This chapter outlines the hazards peculiar to the Chaparral system and, where applicable, gives handling precautions and procedures.

HANDLING HIGH PRESSURE AIR SYSTEMS

The air compression and purification system of Chaparral contains air compressed to a pressure of 3,000 pounds per square inch gage (psig). An explosive and fragmentation hazard exists, and contact with a high-pressure leak can result in tissue puncture and freezing.

Personnel who handle high-pressure airhoses and components should be thoroughly trained in the use and maintenance of the equipment and in the application of safety measures to protect against existing hazards.

The following precautionary measures should always be taken:

- Inspect all systems using high-pressure air before, during, and after use for leaks, defective airhoses or lines, improperly adjusted valves, malfunctioning regulators and relief valves, and presence of foreign materials in the system.

- Clean all airhoses, air lines, and valves at regular intervals. Release pressure through bleeder valves before disconnecting any lines or hoses or making any repairs.

- When pressurizing a system, personnel operating the valves should stand clear of hose connections and should turn the valves slowly to prevent shock loading or pressure surges which may damage hoses or components. Close valves by hand to prevent overtightening; never tighten with a wrench or tool.

- Observe the following precautions pertaining to high-pressure airhoses:

    - The minimum bending radius for flexible airhoses is 4 inches for 1/4-inch inside diameter (ID) hose, 6 inches for 3/8-inch ID hose, 7 inches for 1/2-inch ID hose, and 9 1/4 inches for 3/4-inch ID hose.

    - Never coat or paint an airhose. Paint will impair the normal breathing tendency of the hose.

    - When not in use, depressurize and protect airhoses from the sun.

    - Do not kink, twist, strike, walk on, run over, jerk, or otherwise abuse airhoses.

EXPLOSIVE HAZARDS

Chaparral MIM-72A, 72B, and 72C missiles contain explosives. All safety regulations applicable to missiles and explosives will be strictly enforced. Explosive components containing electrical wiring must be protected at all times from stray voltages or induced electrical currents. Handling, storage, and firing precautions are contained in AR 385-62 and TM 9-1300-206.

WARNING

No electrical checks will be made on the S&A device at any category of maintenance. Only visual inspection, as described in TM 9-1410-585-14, will be performed.

- Explosive hydrogen gas is generated during charging of the batteries. Insure that the battery box lid is closed and latched.

- Exercise care in filling the MPU fuel cells. Do not spill fuel into the base compartment. Check MPU fuel lines and connections periodically for leaks. Fuel vapors forming in the base compartment can explode by a spark from the electrical system.

TOXIC HAZARD

Exhaust gases of the missile motors are a health hazard to persons in an inclosed environment, such as the mount, if the environmental pressurization system is malfunctioning or inoperative.

MECHANICAL HAZARD

Before performing maintenance in the vicinity of the mount or inside the mount well while the mount is in the elevated position, insure that the mount up-lock pins are engaged and the four wooden safety blocks are installed.

NOISE HAZARD

A dangerous noise level exists in the vicinity of the Chaparral system when missiles are launched. Permanent ear damage may result to personnel during missile launching if they are at distances less than 200 feet. The gunner must wear the communication-type headset provided for adequate protection within the mount.

ROCKET-MOTOR HANDLING PRECAUTIONS

- The S&A device, warhead, and motor are dangerous and must be handled accordingly.

- No electrical checks will be made on the S&A device during any category of maintenance.

- Do not remove the red plastic cap from the electrical connector on the target detecting device (TDD) until ready to assemble.

- Never attempt to cool, cover, or move an assembled missile that has been subjected to intense heat.

- If a motor not assembled with a missile should ignite, the forward head will blow out at 350-psi chamber pressure, propelling the head with a force of approximately 7,000 pounds. The head will blow straight forward but no fragmentation will occur. Following ejection of the head, the propellant may burn for 1 minute. The burning is orderly, with no sparks, propellant, or solids being ejected from the motor.

Do not stack bare motors. Stack or store them in their containers in a horizontal position. Never place a motor over a sharp edge. This may dent the motor case and cause separation of the propellant from the case or propellant cracking. The weight of the motor should be distributed equally along its axis.

WARNING

Do not tamper with the rocket motor. Any attempts to adjust, replace, or repair any item except by the specific instructions contained in TM 9-1410-585-14 can result in an immediate hazard to both operating personnel and equipment.

In normal handling the motor can be ignited by an electrical current through the squib bridge wires or by external heat sufficient to raise the igniter temperature to 525°F. The risk of handling the motor mated with missile warhead is greatly increased since, upon ignition, the unit becomes highly propulsive and will explode or fragment upon striking a solid object.

The ***major hazards*** in handling and storage of the rocket motor are as follows:

- Accidental activation of the igniter due to electromagnetic radiation, induction, or direct application of power to the igniter circuit.

- Auto-ignition of the motor or igniter due to fire or other external heat sources, including local heating by power tools.

- Ignition of the motor propellant due to impact or grinding action encountered in dropping, adjustment, repair, replacement, or otherwise tampering with motor components.

HANDLING OF MISFIRES

The Chaparral missile or the associated firing circuitry may malfunction, and the missile will not leave the rail. Should a missile malfunction, the following procedure should be followed.

- Keep the canopy closed.
- Set the ARM switch at OFF, turn the MODE switch to STANDBY, and set the TRIGGER lock switch at OFF.
- Keep the missile pointing downrange.
- If the tactical situation permits, wait 15 minutes before removing the missile.
- Unload the missile from the launcher and move it to a designated safe area.

CAUTION

Do not attempt to dismantle the missile body. Notify the supporting explosive ordnance detachment (EOD).

PART II

CHAPARRAL TRAINING

CHAPTER 6

UNIT TRAINING PROGRAM

This chapter discusses techniques used to establish a training program for the Chaparral squad. The proficiency of Chaparral squad members results from training. Planning and preparing military training are covered in detail in FM 21-6, How to Prepare and Conduct Military Training.

The Chaparral battery commander has the authority and responsibility for planning, directing, conducting, and supervising training. He trains his squads to the highest degree of operational readiness allowed by the availability of:

- Personnel.
- Equipment.
- Time.
- Funds.
- Facilities.
- Operational requirements.
- Installation support requirements.

He accomplishes this by using his officers and noncommissioned officers to schedule and conduct planned training.

TRAINING OBJECTIVES

The objectives of unit conducted training are to—

- Qualify Chaparral crewmen to expertly perform all the duties of their position, qualify each crewman to effectively perform the duties of all other squad positions, and prepare the crewman for advancement in his MOS. The same MOS, 16P, applies to the Redeye gunner. The skills and knowledges that a short-range ADA missileman, MOS 16P, needs to successfully execute his duties are discussed in this manual, FM 44-23, and FM 44-23-1, and are listed in FM 44-16P, Soldier's Manual, Short Range ADA Missile Crewman.

- Develop squads into coordinated combat teams capable of rapid and correct response to the mission requirements of the battery.

TRAINING ASSESSMENT

The battery commander bases his assessment of the unit and individual training proficiency on:

- Personal observation.
- Sampling techniques.
- Performance tests.
- Field exercises.
- Soldier's qualification tests.
- ARTEP.

The training assessment is essential to the success of the training program for Chaparral crewman and is used to identify training needed.

[illegible]

In making this assessment, the battery commander must:

Determine each ***crewman's current proficiency*** by **analyzing** the:

- Experience level, including results of previous training of the individual crewman, in his assigned position.
- Overall training level of the battery. To do this he conducts diagnostic tests such as equipment maintenance inspections, equipment operating tests, field exercises, and squad drill exercises.
- Result of the last skill qualification test (SQT) and Army training and evaluation program (ARTEP) to see if any deficiencies surfaced because of poor crewman performance.

Determine what ***training will be necessary*** to meet required training standards by:

- Comparing results of the analysis of the current proficiency with the required training standards contained in the Soldier's Manual.

- Finding out the levels of training required to bring personnel up to the proper standards.

Determine how much ***time*** is available to achieve the required standards by:

- Examining the time required for the battery's overall mission requirements and other obligations.
- Deciding how much training needs to be done.

Determine what ***resources are required*** to train crewmen by:

- Referring to results of the latest ARTEP as an indicator of training resources required for further training.
- Referring to unacceptable scores received on the latest SQT and planning for resources needed to further train crewmen.
- Reviewing previous training experience of the battery indicating previous resources used.

Determine what ***resources*** in time, personnel, and equipment are available to conduct training by:

- Inventorying battery equipment and evaluating its readiness.
- Inventorying other equipment, ranges, etc., that can be used when required.
- Determining what assistance is available from supporting units and higher headquarters.

Reconcile all considerations. Differences between resources required and resources available will affect both the time required to conduct the training and the battery's ability to meet the required standards.

[illegible]

In the assessment process, the battery commander has begun outlining his Chaparral training program. To construct a detailed plan for implementing the program, the battery commander must:

Start early. To produce the desired results, all aspects of a training program must be completed and coordinated. Determine the required resources and maintenance assistance long before they will be used.

Be thorough. Do not leave anything to chance, or resources will be wasted and training opportunities will be lost.

Be flexible. Continuously adjust the training program to the changing needs of the battery. If planning stops, the training program stagnates and loses its effectiveness.

Be innovative. If resources are not available to support one method of training, look for alternative methods. Simulated firing at radio-controlled miniature aerial targets (RCMATs) in a training area could be substituted when a live firing range is not available.

A crewman with MOS 16R must be cross-trained so that he is able to perform adequately in all positions and proficiently in his assigned position. To accomplish this cross-training, personnel in the squad must be rotated temporarily among positions and the man most proficient in a position assigned to that position. It may become necessary to move a crewman between squads to meet this goal. The squad must operate as a well-coordinated team.

[illegible]

The usual crewmen attrition rate for a Chaparral battery is approximately 30 percent annually. Replacements are usually graduates of advanced individual training and require additional training before becoming fully qualified as Chaparral crewmen. On-the-job or augmentation training for replacements should be planned as a continuing program.

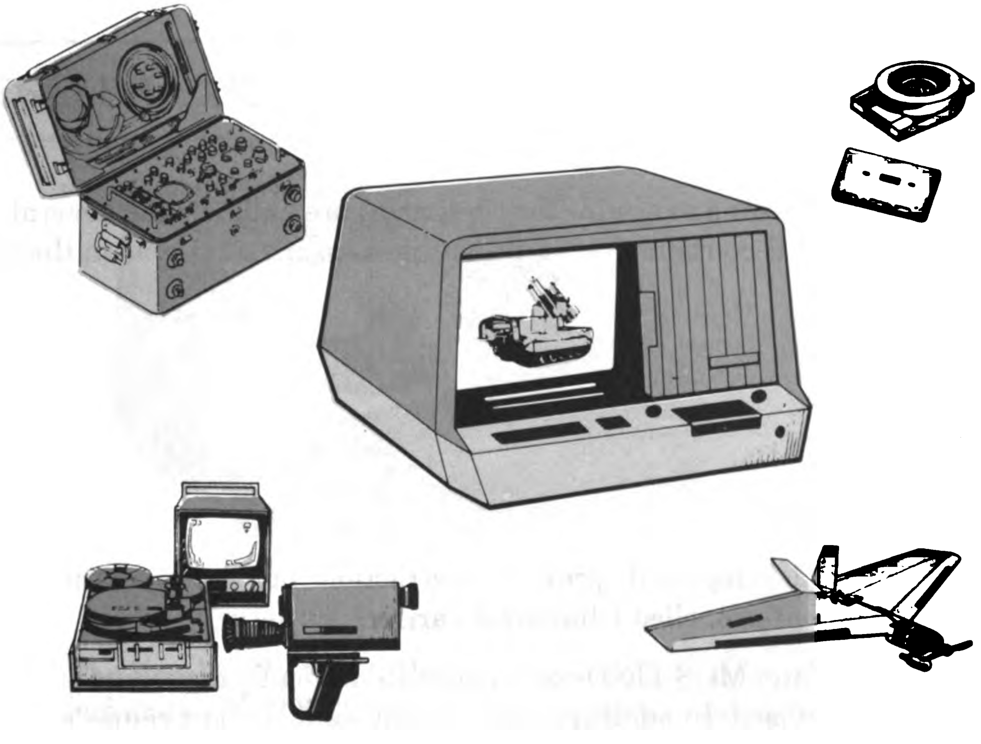
CHAPTER 7

TRAINING DEVICES AND HOW TO USE THEM

A training program should emphasize weapon system training and firing procedures to develop and maintain crew proficiency at a high level. A number of training devices have been developed which, if used properly, can add realism to the training program. The use of these devices is less costly than conducting live firings and permits training to be conducted at the home station.

This chapter discusses the training devices available to support the training of Chaparral crewmen. These devices serve to promote gunner and crewman efficiency, shorten training time, maintain gunner proficiency, and effect savings in resources.

CHAPARRAL TRAINING DEVICES



WHAT TEC IS

The Training Extension Course Training System is designed to assist individual soldiers in increasing job proficiency. It consists of audiovisual lessons using audiovisual projectors and cassette tape players, audio-only lessons, and printed text lessons.

As an integral part of unit training programs, TEC provides performance oriented training in many subjects needed by Chaparral crewmen. These subjects include skills that are common throughout the Army as well as those necessary for operation and maintenance of the Chaparral weapon systems.

Use of TEC lessons provides flexibility in the unit training program and allows commanders to concentrate on skills required by individual soldiers. TEC lessons can be presented:

- In unit learning centers, classrooms, or in the field.
- To individuals or small groups.
- As self-paced instruction.
- To correct a specific shortcoming.

Most MOS TEC lessons available for Chaparral are audiovisual; several are audio only. Appendix B contains a current listing. Lessons available in the field cover:

- Maintenance
- Crew drill
- Tactics
- Missiles

Lessons under development provide instruction on the operation and maintenance of the self-propelled Chaparral carrier.

Common subject and MOS TEC lessons are automatically distributed to units when completed or revised. In addition, each audiovisual support center receives copies of the lessons. These are used to replace, by direct exchange, lessons found to be damaged or defective.

HOW TEC IS USED

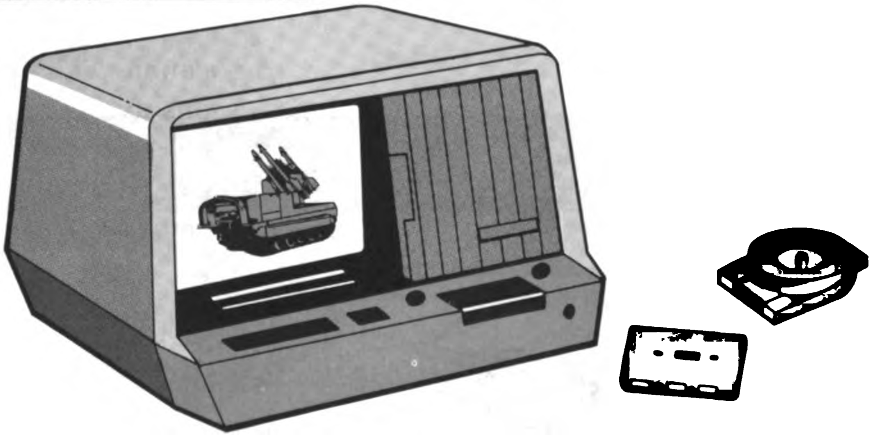
Each lesson contains lesson administrative instructions (LAI) which provide guidance on how to use the TEC training method to identify and solve training deficiencies. To identify training deficiencies, the trainer is provided with pretests and post tests in the LAI. The soldier's proficiency can be determined by having him take the pretest. For example, if the soldier passes the test, he does not need the training; on the other hand, if he does not pass it, the lesson is prescribed for training. The post test is used to determine whether the soldier did learn the lesson; if not, he can repeat the lesson.

TEC lessons are developed to allow the soldier to work on his own and at his own speed.

Material telling how to effectively use TEC lessons is obtained from:

- TEC lesson 920-061-0550-F, Introduction to TEC.
- TEC lesson 920-777-0505-A, TEC for Green Tabbers. Also, TC 21-5-3, TEC Management Instruction, contains guidance on how to use the TEC system and develop the unit's support structure for TEC.

BESELER CUE/SEE



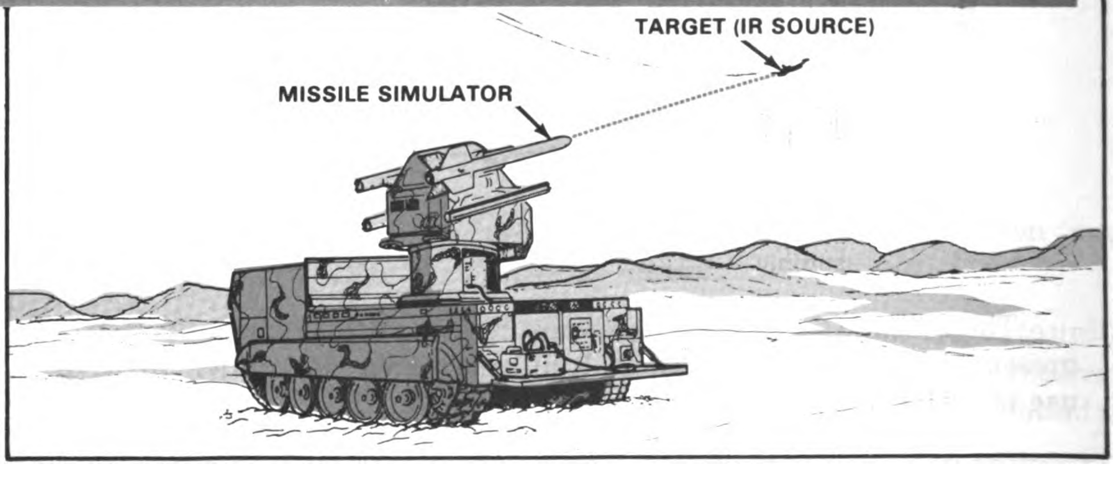
The Beseler Cue/See is the primary training device currently used to present audiovisual TEC lessons. It affords a great deal of flexibility for use with individuals, small groups, or large groups.

The Beseler Cue/See can be used for training in all aspects of squad procedure. The lesson is presented via a super 8-mm continuous loop video cassette that is synchronized with an audio tape cassette. The lesson is normally presented on a 6x3-inch screen on the front of the Beseler Cue/See. However, by opening a small door at the rear of the device, the picture can be projected onto a normal screen or classroom wall for larger groups. The film speed can be adjusted from a single-frame to 24 frames per second. Frames may be stopped automatically to allow some action by the student such as reading a procedure from a technical manual or answering a question. The Beseler's light weight and small size allow it to be used almost anywhere. Each Chaparral/Vulcan battalion is authorized Beseler Cue/Sees.

AUDIO-ONLY TEC LESSONS

Audio-only TEC lessons can be used to assist the trainee in performing a complicated procedure. By using the audio-cassette player, the trainee can perform the procedure using instructions presented on the audio tape. As an example, audio lesson 043-441-7882-E provides instructions on operating and driving controls of the Chaparral carrier M730.

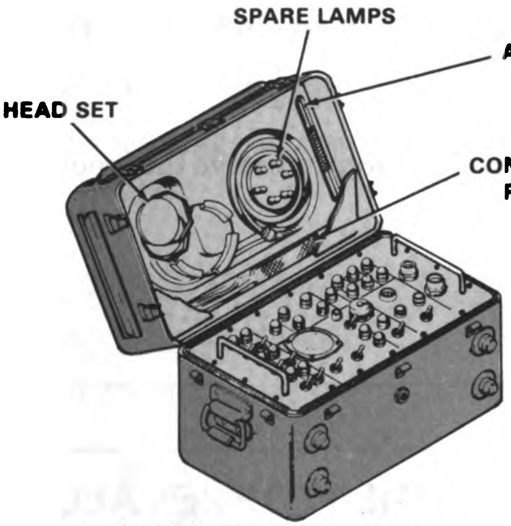
CHAPARRAL SIMULATOR/EVALUATOR SYSTEM



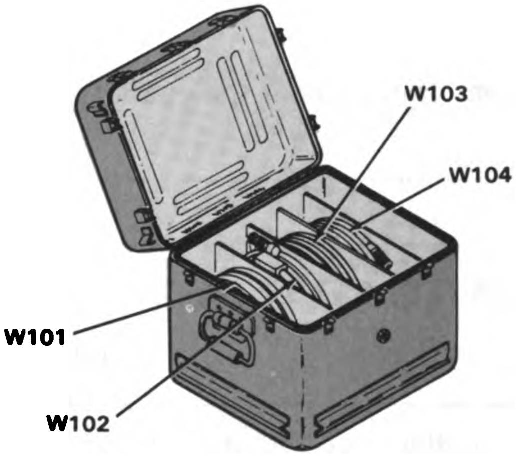
The Chaparral simulator evaluator (CSE) provides the means to train Chaparral gunners in the basic gunner functions associated with target engagement. It also provides the means to assess gunner tracking ability with real targets. Additionally, the instructor can monitor the gunner's response to critical and noncritical system malfunctions that he could encounter during actual operations.

The simulator evaluator (or Monitoring Set, AN/TSQ-T3) consists of two major items: the Chaparral missile simulator and the simulator/evaluator.

- The missile simulator is a tactical missile guidance control section (MK-28 or AN/DAW-1) that is connected to the M30 training missile. It s operating characteristics are identical to the Chaparral missile, except for launch and flight. It also provides authentic tone response to the gunner on which he has to base his decision to launch.
- The simulator/evaluator consists of two assemblies: instructor control/indicator assembly (IC/IA) and cable assembly group.



Instructor Control/Indicator Assembly



Cable Assembly Group

The IC/IA is used by the instructor to monitor gunner response and performance, to provide communications with the gunner, and to control the gunner training exercise. As an aid to the instructor, the control panel indicators are laid out in the same manner as the indicators and switches in the gunner compartment. The equipment is emplaced and set up as described in TM 9-6920-585-12. A brief description of what the instructor can accomplish with the CSE follows. The instructor can:

- Monitor when the gunner has turned mount power on, has switched to the operate mode, has selected the proper rail, and has armed the missile.
- Simulate a warning and interlock condition and the gunner's response to the condition.
- Hear missile tone whenever the gunner is on target (simulated or actual). Monitor how well the gunner is able to track per tone and whether he had tone when he fired.
- Monitor the gunner's ability to track a target, observe the amount of tracking error and score the gunner.
- Determine if the gunner fires properly.

HOW TO TRAIN WITH THE SIMULATOR/EVALUATOR (AN/TSQ-T3)

Emplace and set up the simulator/evaluator as described in section II, TM 9-6920-585-12. Energize the CSE as described in table 3-2. The CSE is ready for system operation.

INTERLOCK AND WARNING INPUTS

The use of interlock and warning inputs from the AN/TSQ-T3 should be limited during simulated engagement because it will disrupt tracking practice. The instructor should insert interlock and warning problems during preoperational checks by the gunner. In any case, when the instructor gives the gunner simulated interlock and warning inputs from the AN/TSQ-T3—

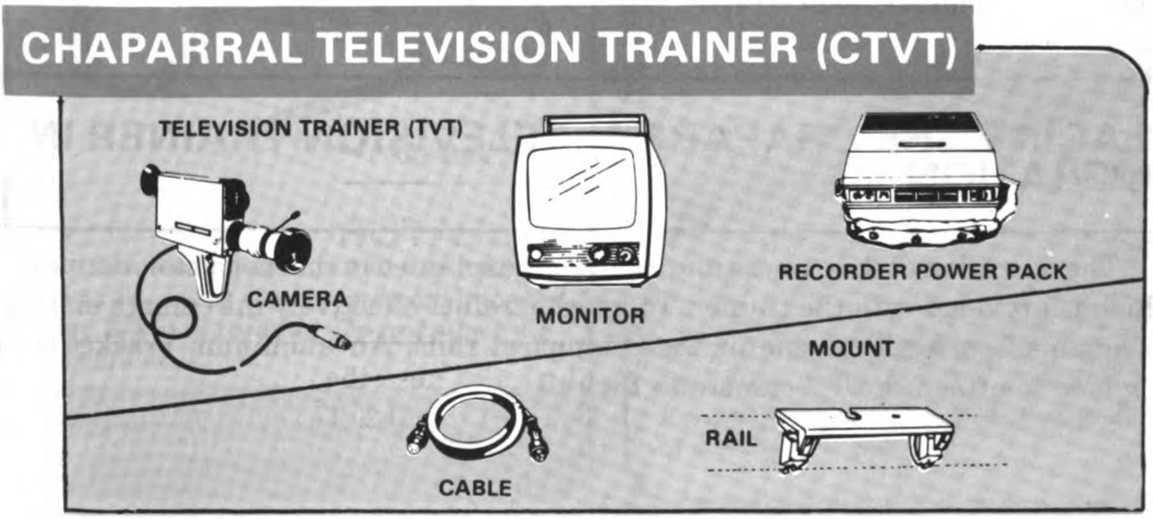
- The gunner must recognize the interlock/warning and report it to the squad leader within 5 seconds, and the squad leader must take corrective maintenance action to prevent equipment damage, or—
- Command the gunner to use the interlock override and engage the target.

TRACKING

The instructor watches the gunner's tracking techniques on the TV monitor to insure that the—

- M75 sight reticle image is positioned on target.
- Smooth tracking of the target is maintained.
- Missile tone is available at the moment of engagement.

Use the training exercises in tables 3-3 through 3-9 of the TM to evaluate and score the gunner.



This device is used to train Chaparral gunners in tracking aerial targets. It allows the instructor/evaluator or other crew members to monitor the actions of the gunner as he acquires, tracks, and fires on the target. In addition, the trainee gunner can also critique his performance by watching a playback of the audio-visual tape on the TV monitor. The device is excellent for correcting gunner mistakes on the spot.

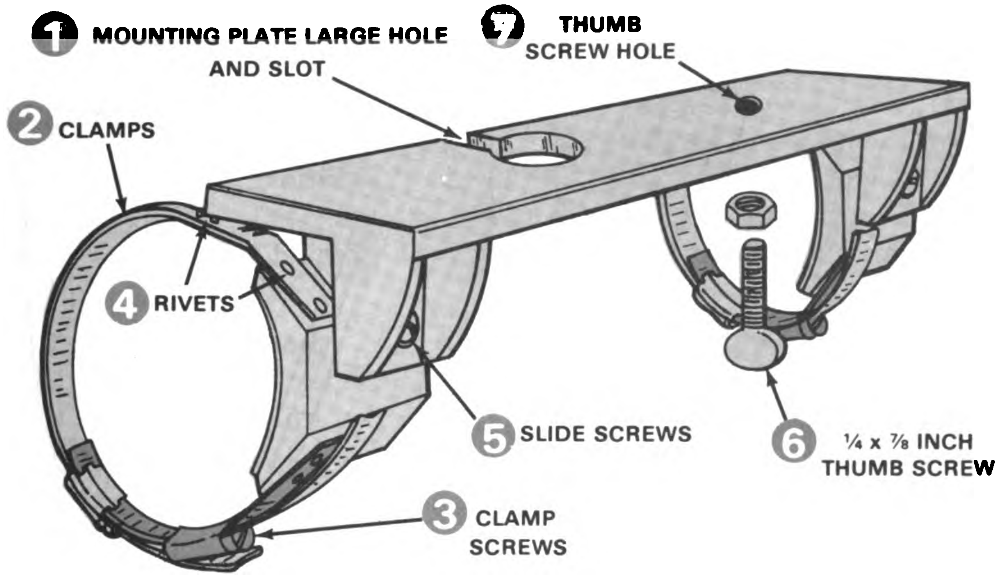
The TVT consists of a camera, TV monitor, video tape recorder/power pack, and two batteries (plus the required connecting cables). The camera is mounted on a Chaparral rail camera mounting bracket.

A necessary item for use with the trainer, but not included as an accessory to the TVT, is a 32 foot coaxial extension cable used to remote the TV monitor and recorder from the Chaparral. The cable is a GSA item (part no. GS-095-37054/CCJ-10), which can be requisitioned through the supporting Training and Audiovisual Support Center (TASC). The TVT, as issued, includes system accessories, an operator's manual and a maintenance manual.

Each US Army Chaparral/Vulcan battalion is issued two television trainers. Schools and academies are issued trainers in quantities determined by the supporting training and audiovisual support center. In CONUS, the trainer is issued on an extended loan basis by the TASC and in oversea areas by Audiovisual Support Centers (AVSC). If a unit does not have the TVT, a request for loan of the trainer may be made to the support center using DA Form 4103-R, Training and Audiovisual Support Loan Order.

PLACING THE CHAPARRAL TELEVISION TRAINER IN OPERATION

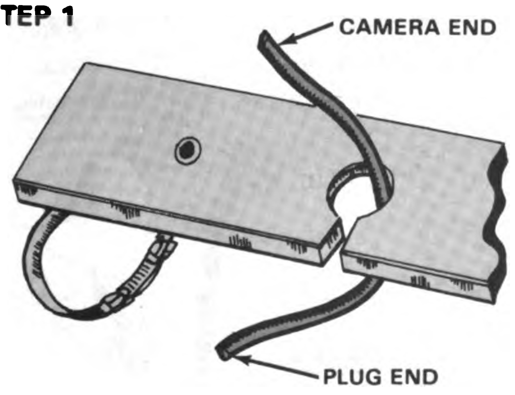
The operation of the camera and monitor is explained in the instructor manual which is provided with the trainer. To use the trainer effectively the camera must be mounted correctly to one of the Chapparal rails. An aluminum bracket is provided to attach the TV camera to the rail.



The Chaparral rail mounting bracket is a modified version of the Redeye mounting bracket used with the TVT system. Two 4-inch long hose clamps of the same type are used to extend the hose clamps riveted to the mount.

The steps for attachement are as follows:

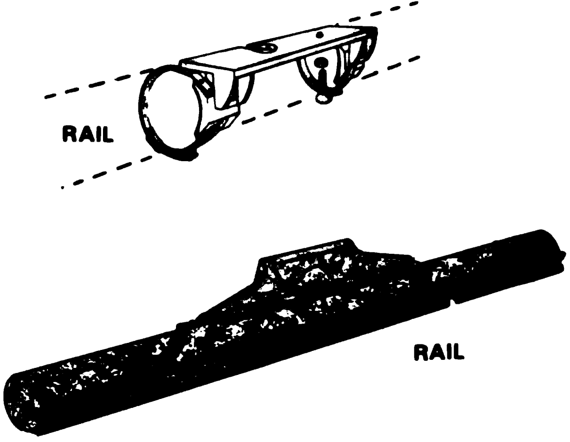
STEP 1



As another person holds the camera securely, insert the camera cord into the **slot** ① in the bracket. ***Do not*** attach the camera now.

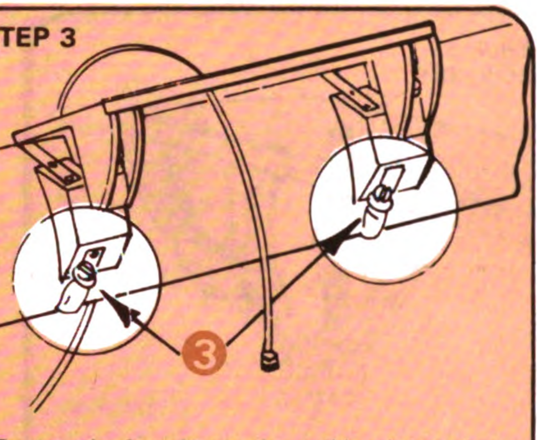
CAUTION: Cord cannot be put in after bracket is attached to launcher.

STEP 2



Place the **clamps** ② around the upper right launch rail. Move the bracket as far forward as possible (this allows best field of view for the camera).

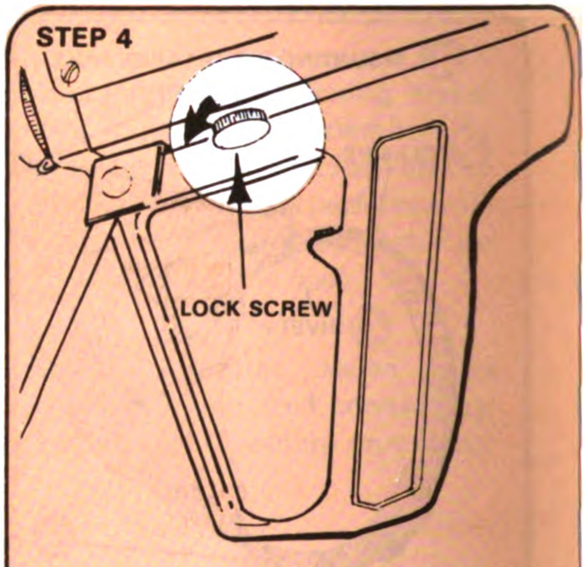
STEP 3



Fasten the bracket to the rail by tightening the **clamp screws** ③.

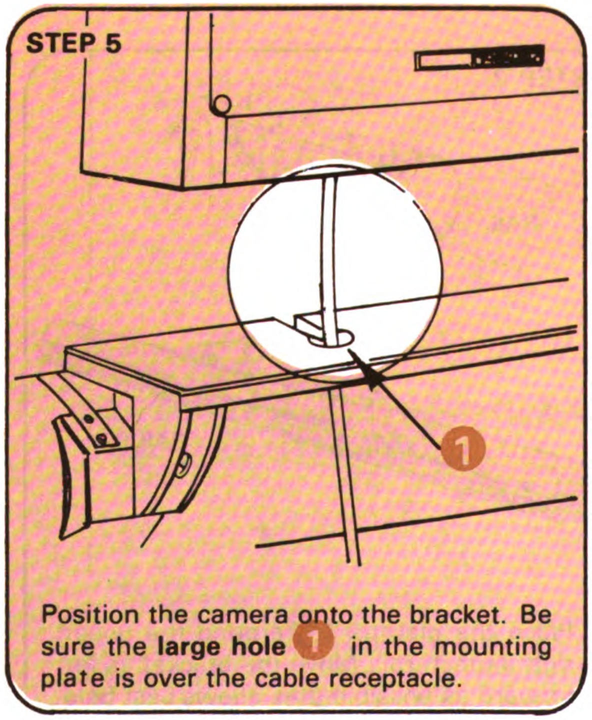
CAUTION: The bracket must secure the camera in a stable, upright position. But don't overtighten the screws or you may pop the rivets ④.

STEP 4



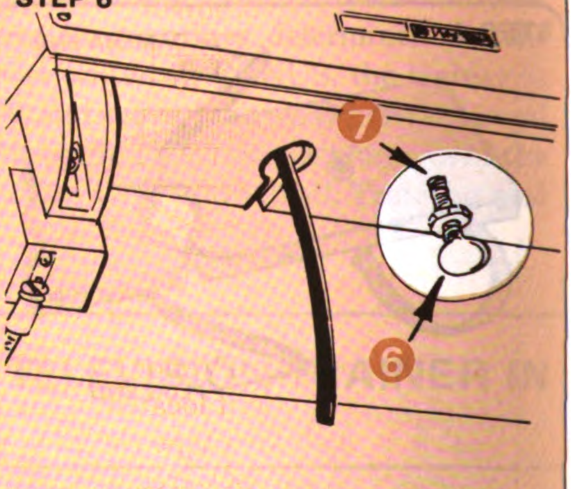
Remove the camera trigger grip by turning the knurled lock screw to the left (counterclockwise).

STEP 5

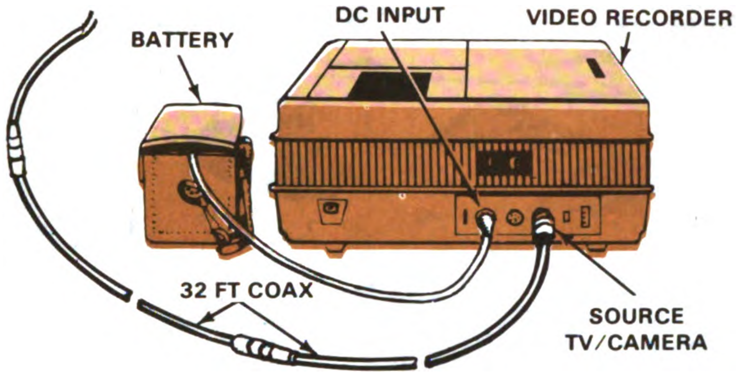


Position the camera onto the bracket. Be sure the **large hole** ① in the mounting plate is over the cable receptacle.

STEP 6

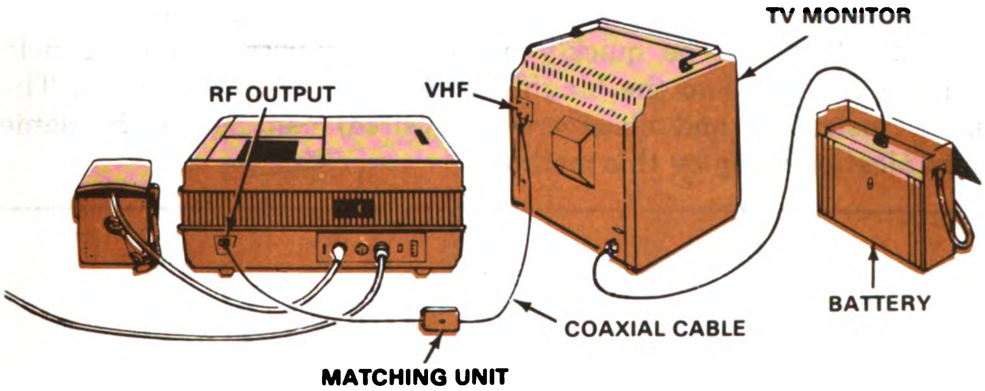


Attach the bracket to the camera with a 1/4 x 7/8-inch **thumb screw** ⑥ (there should be one in the kit). The screw goes up through the mounting plate and into the **hole** ⑦ where the lock screw was.



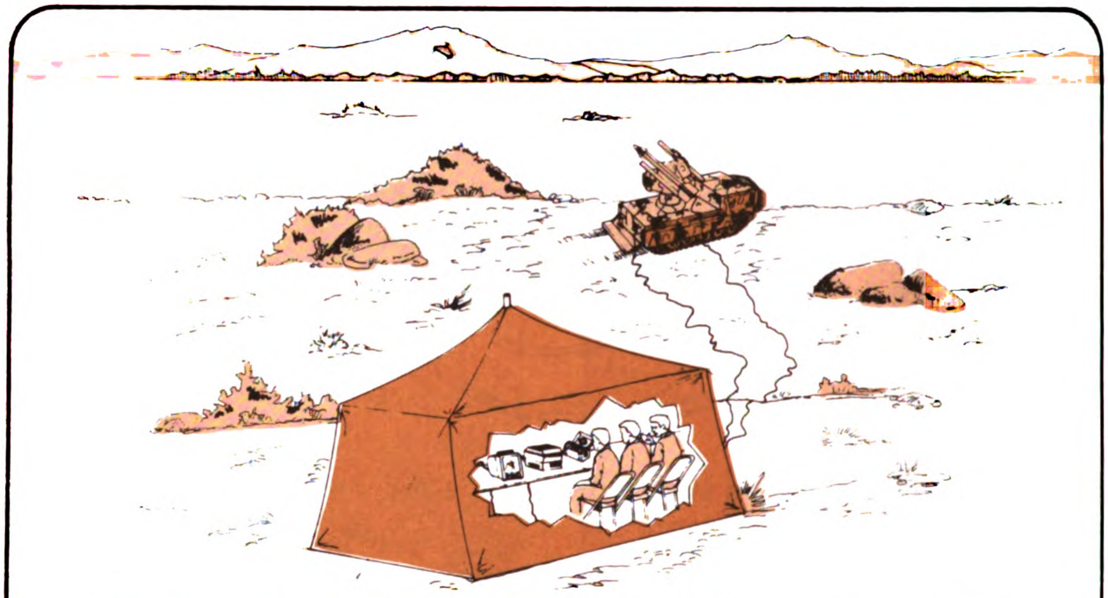
Connect the camera lead to the video recorder where the recorder is marked "Source TV/Camera."

The video tape recorder is powered by a battery furnished with the unit or by a 115v ac source. Plug the power source lead into the video tape recorder where it is marked: DC INPUT. Consult TVT operator's manual for procedures.



Connect the TV monitor to the video tape recorder by a coaxial cable and matching unit located in the TV monitor case. Connect this coaxial cable to the video tape recorder where it is marked RF output. The TV monitor may be powered by a battery located in the TV monitor's case or 115v ac. (See TVT operator manual for procedures.)

Connect the other end of the cable to the VHF antenna connectors on the TV monitor. Set the TV/VTR switch on the monitor to VTR.



The TV monitor and video tape recorder should be collocated with the AN/TSQ-T3 behind the Chaparral carrier on a stable platform. These items should be in a shaded position (such as the back of a truck or in a GP Med tent) to avoid sunglare on the TV monitor and possible heat damage to the tapes.

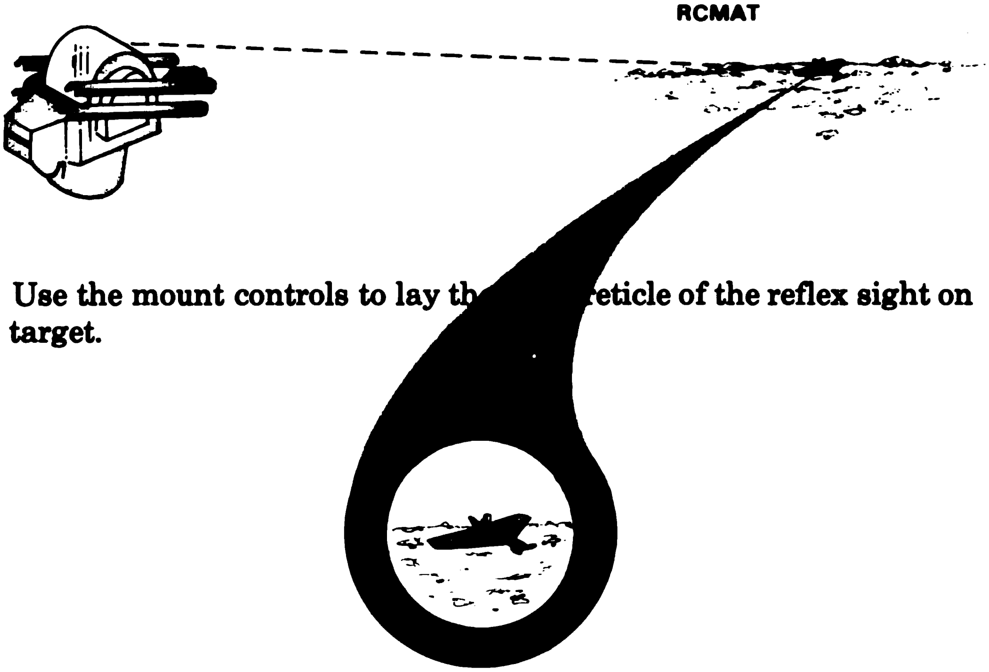
Provide a communications link between the gunner and the instructor. This can be quickly accomplished with a TA-312 field telephone connected to the bindingposts of the weapon system. The gunner, instructor and observers (if desired) can be on the same communications loop by this method.

ALINEMENT

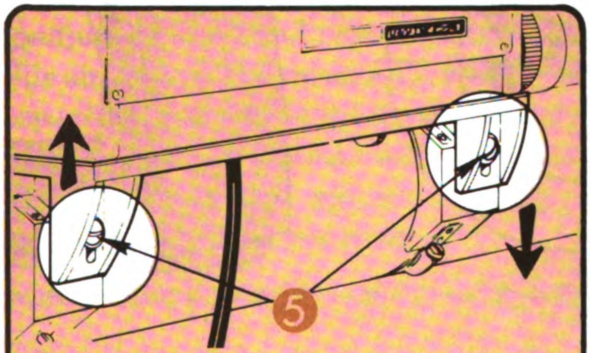
It is necessary to aline the equipment so that the camera and TV monitor "see" the same picture the gunner sees in his reflex sight. The following is a recommended procedure:

Place the model aircraft that is to be tracked on the ground about 400 meters from the Chaparral sight.

Google



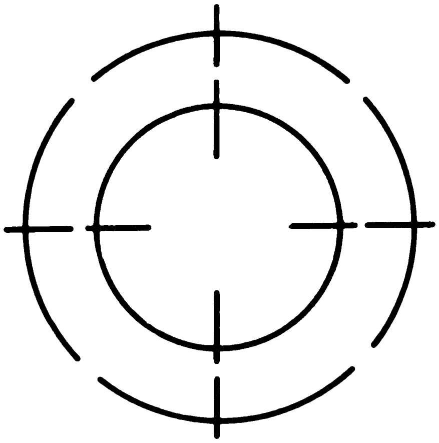
Use the mount controls to lay th[illegible]eticle of the reflex sight on the target.



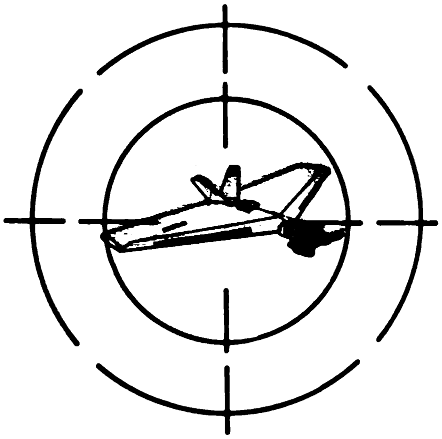
The camera can be adjusted up or down by using the **slide screws** for the mounting plate. Use a screwdriver to loosen the screw, tilt the mounting plate as necessary, tighten the screws.

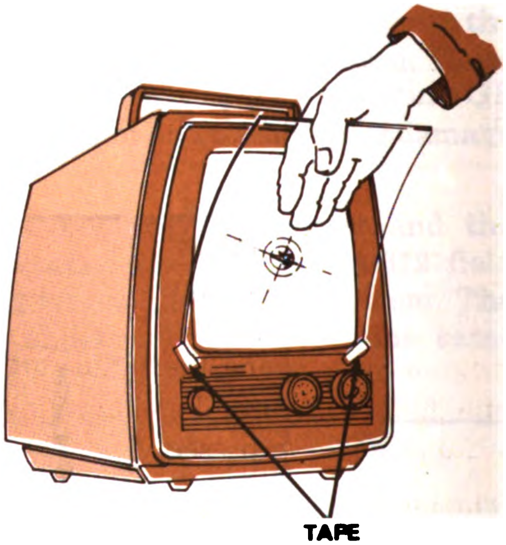
CAUTION: Don't overtighten the screws or you'll strip the threads.

Look into the camera to see if the camera is centered on the target. Adjust the mounting bracket to correct centering, if necessary.



- Prepare an overlay by copying this reticle design on a piece of clear acetate with ink or crayon. The acetate should fit the monitor glass protective cover.

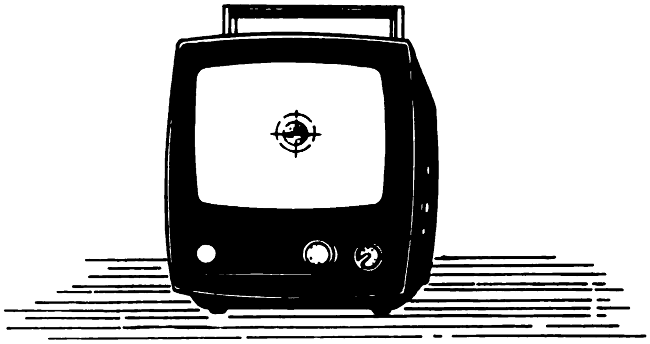




- Place and tape the previously prepared overlay on the monitor display area protective glass so that the RCMAT in the gunner's sight reticle appears in the same relative position on the overlay.
- Adjust the f-stop and focus rings on the camera for the clearest image on the monitor.

The Chaparral sight, camera, and monitor are now boresighted at the average range at which the RCMAT will be tracked as it travels in its flight path.

- The monitor screen now looks like this:



USING THE TV CAMERA

Immediately following visual contact with the target the gunner establishes smooth tracking by adjusting the hand controls until a discernible IR signal is received by the missile simulator. The missile simulator then generates a missile tone. The gunner keeps the target within the inner circle of the sight reticle. Upon hearing the missile tone, the gunner announces, TONE, over the intercom. When a missile tone is heard, he maintains smooth tracking until he launches in accordance with the prescribed firing sequence.

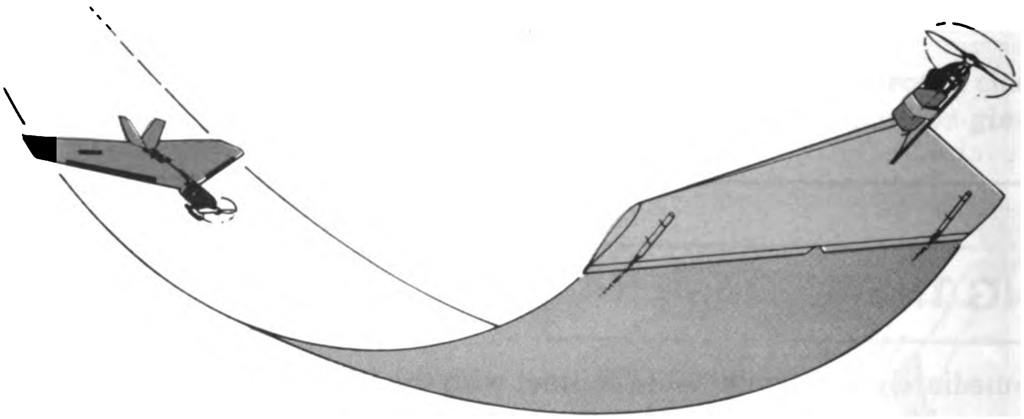
The instructor watches the gunner's tracking technique on the TV monitor to insure that—

- The target is properly positioned in the sight reticle on the monitor.
- Smooth tracking on the target is maintained.
- Missile tone is available at the moment of launch.

The cost and difficulty of scheduling aircraft for tracking make it necessary to take full advantage of available time by tracking every course. However, the trainee should be critiqued after each course and before conducting a second engagement. Whenever possible, he should observe a video playback of the engagement as part of the instructor's critique. When necessary, videotapes of each engagement can be stored until all trainees have completed a simulated engagement.

Using the field telephone at the TV monitor, the instructor is able to point out tracking errors and make corrective recommendations to the gunner during and after each tracking course. This can also be done at the weapon using the T-3 when the TV trainer is not connected.

RADIO CONTROLLED MINIATURE AERIAL TARGETS



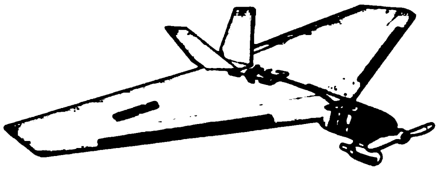
To maintain proficiency Chaparral gunners must track and practice engagement of aerial targets frequently. However, because of the high cost of using real aircraft to fly tracking missions, it is difficult to obtain sufficient tracking practice. To overcome this training limitation, more gunner training must be done at the home station using innovative training techniques and devices to simulate real aircraft. This training requirement has been met with the development and use of model aircraft as flying targets in unit training areas.

The radio controlled miniature aerial target (RCMAT) is a durable target capable of providing an accurate simulation of an attacking aircraft. It provides an excellent target for detection, acquisition, tracking and simulated firing with the Chaparral system.

RCMAT are available through training and audiovisual support centers. They are normally issued in kit form.

- Kit, Airframe, RCMAT, contains 3 airframes, engine, 10 propellers, 4 glowplugs, and assembly materials.
- Kit, Transmitter, RCMAT, contains 3 transmitters on 25.450 MHz, and 3 transmitters on 25.534 MHz.
- Kit, Ground Support Equipment, RCMAT, consists of Station Case, Operator's Manual, Parts Box, 3 Flight Boxes, 2 Tool Sets, and Electrical Test Equipment.

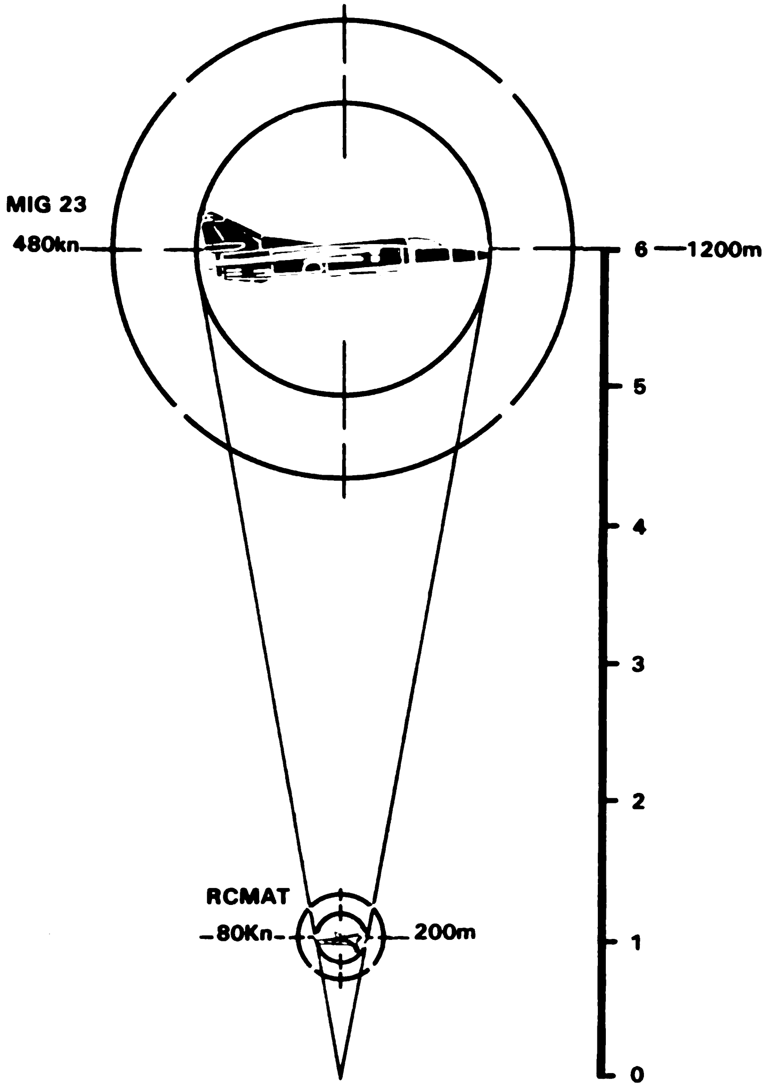
Assembly and operation of the RCMAT is the responsibility of the using unit, normally the battalion. One trained operator and a helper are required.



RCMAT CHARACTERISTICS

Engine: Gas powered, propeller driven.
Size: 1/6th Scale of Threat aircraft.
Control: Ground-based, radio-controlled equipment.
Airspeed: From 25 to 80 Knots.
Launching requirements: Hand launched.
Visibility: Satisfactory to about 800 meters.
Maneuverability Representative of full scale aircraft.
IR flare burn time: About 15-20 minutes.
Maximum flight time: 16-20 minutes depending on speed.

Using a tracking range or tracking area, units can realistically simulate Chaparral engagement of real aircraft. When using the RCMAT, remember to adjust for the scaled down version of a real aircraft. To give relative figures, the following diagram shows the relationship between the model and an actual aircraft when tracking a crossing target. Target speed, distance traveled, and time of flight are approximate figures.



The RCMAT has approximately 1/6 the speed, visual size and radar signature of a full size threat aircraft. When it is flown at scale distances, it simulates the performance envelope of the target aircraft to give the trainee a realistic adversary for his tracking training.

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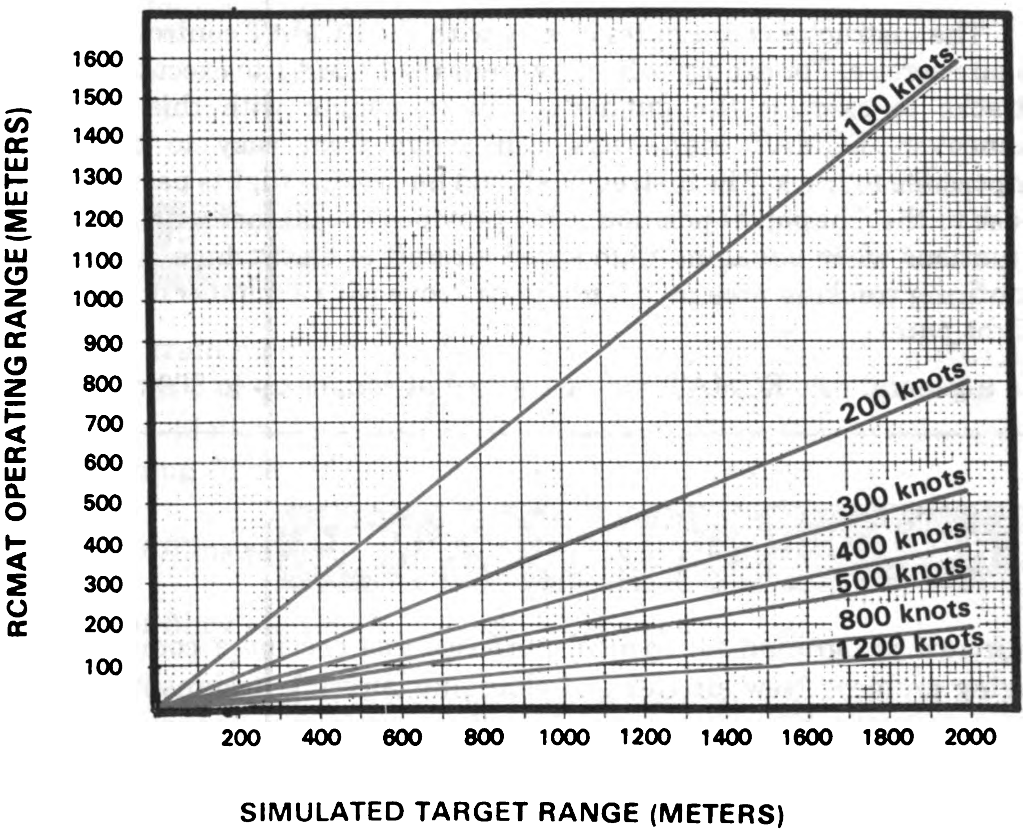
The chart below gives an idea of representative distances from the Chaparral fire unit to the target (real aircraft versus RCMAT).

80 KNOT RCMAT

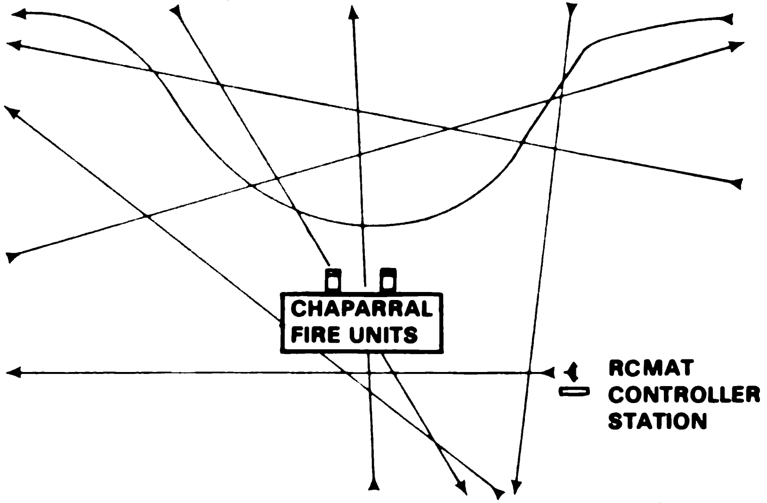
Operating Ranges
vs
Simulated Target Range
(Equal tracking rate at
representative speeds)

$$R_{(RCMAT)} = \frac{SP_{(RCMAT)} \times R_{(TGT)}}{SP_{(TGT)}}$$



Step 1. Locate desired simulated target range along bottom line of chart.
Step 2. Move up chart along this line until desired target speed intersects with this line.
Step 3. Then left to find operating range for the RCMAT.

USING THE RCMAT



The instructor coordinates closely with the RCMAT controller prior to an exercise. For example, he may want the RCMAT to execute pop-up attacks to exercise the gunner's skill in coping with this type of maneuver. RCMAT maneuvers can range from easy to track to impossible to track. The instructor should have some flights pass over or close to the Chaparral position. This provides the gunner with realistic situations when engaging high speed aircraft at close range. A sample nonfiring tracking area layout is shown above with a number of selected flight paths.

As a general rule RCMAT can be tracked at ranges up to 800 meters.

AIRCRAFT RECOGNITION TRAINING

Aircraft recognition for tactical purposes has become a complex and ever changing problem. New aircraft and changing aircraft designs have become a continuous factor. Also, some not so friendly countries have bought aircraft from some friendly countries which may cause some normally friendly aircraft to become threat aircraft. This ever-changing situation poses a real challenge for those who teach visual aircraft recognition. Perhaps the biggest problem in recognition has been teaching it in an effective and realistic fashion.

Troops must be trained to be proficient in quick aircraft recognition. Hostile low-flying aircraft may appear suddenly from behind low hills, belts of trees, or haze. High-speed aircraft are difficult to identify.

Accurate visual recognition of aircraft is essential to Chaparral crewmen in making their engagement decision. It is vital that recognition be *swift* and *accurate*. Individual crewmen should be experts at recognizing all friendly and potentially hostile aircraft expected to be operating at low altitudes in a specified combat zone. Each Chaparral crewman should approach 100 percent recognition accuracy with 90 percent being a minimum acceptable level of proficiency.

Aircraft recognition training for ground observers is covered in detail in TC 44-30, Aircraft Recognition Training For Ground Observers. This training circular should be used as a guide for planning and conducting aircraft recognition training in Chaparral units. The TC tells instructors how to use TEC and GOAR methods of instruction as well as the training aids used with recognition training. It also provides information on how to plan and prepare a training program in this subject. Furthermore, it can be used by those persons who establish training requirements and who evaluate job proficiency of individuals and the combat readiness of Chaparral units.

TRAINING FILMS

US Army training films can be used to support instruction of Chaparral crewmen in both Army-wide skills and in Chaparral operations. DA Pam 108-1, Index of Army Motion Pictures and Related Audio-Visual Aids, is a guide to available training films. Of particular interest to trainers are the:

- 44-Series of films relating to Chaparral and associated equipment.
- 21-Series of films relating to the individual soldier.
- 5-Series of films relating to camouflage and field fortifications.
- 8-Series of films relating to first aid and field sanitation.

In addition to training films, other audiovisual materials are indexed in DA Pam 108-1.

Films and projection equipment are obtained from training and audiovisual support centers.

CHAPTER 8

CREW DRILL

Tactical employment of Chaparral requires the cooperative and timely efforts of all squad members. This chapter describes the duties and responsibilities of each squad member and prescribes a formal drill procedure to be used in training squad members in the performance of their duties.

DUTIES AND RESPONSIBILITIES OF SQUAD PERSONNEL

Squad leader. The Chaparral squad leader is in direct command of the squad and is responsible to the platoon sergeant for:

- Training and efficiency of squad personnel.
- Duty performance of squad members.
- Operation of Chaparral equipment by squad members to include:
  - Chaparral launching station.
  - Chaparral carrier.
  - Communications equipment.
- Site selection, preparation, and improvement.
- Travel, emplacement, and march order of the Chaparral equipment.
- Maintenance of all squad equipment.
- Enforcement of safety rules.
- Selection, designation, and identification of targets.
- Performance of other duties as prescribed by the platoon sergeant.

Gunner. The gunner is second in command of the squad and is responsible to the squad leader for:

- Performance of operator maintenance of the Chaparral launching station, missiles, and communications equipment.
- Operation of the Chaparral launching station.
- Effective delivery of fire on targets designated by the squad leader.
- Performance of other duties assigned by the squad leader.

Driver. The driver is responsible to the squad leader for:

- Operating the Chaparral carrier.
- Performing operator maintenance on the carrier and associated equipment.
- Detecting all aircraft in his assigned area of search.
- Performance of other duties assigned by the squad leader.

Observers. Chaparral observers are responsible to the squad leader for:

- Detecting all aircraft in their assigned sectors of search.
- Assisting the gunner and driver in operating and maintaining squad equipment.
- Performing other duties assigned by the squad leader.

PURPOSE OF SQUAD DRILL

The objective of squad drill is to attain a high degree of proficiency, precision, speed, and teamwork in operating the Chaparral system. To be effective, squad drill should be:

- Conducted in silence except for commands and reports.
- Repeated until squad reactions are automatic, rapid, and efficient.
- Supervised so that mistakes are discovered and corrected immediately.
- Conducted so that each member of the squad can perform all duties within the squad.

SQUAD MEMBER DESIGNATIONS

For the purpose of describing and conducting squad drill, members are designated as follows:

Squad Leader	SL
Gunner	No. 1
Driver	No. 2
Observer	No. 3
Observer	No. 4

SQUAD TRAINING COMMANDS AND FORMATIONS

Training of Chaparral crewmen requires that each crewman be able to perform all duties within the squad. The squad leader will rotate each squad member through each duty position; e.g., No. 1, No. 2, No. 3, and No. 4 during drill.

Note: In the crew drills explained below, the time phasing of crew actions is indicated by the vertical position of the action statements. Where the actions by individual crew members are sequential, i.e., the first action is at the top of the list (SL) and the next action (No. 1) is listed lower on the page to indicate that SL must complete his action before No. 1 starts his. Where actions are simultaneous, they are listed on the same horizontal line.

CREW DRILLS

EMPLACEMENT.

When the Chaparral arrives at the selected position, the system is emplaced and prepared for action in the following sequence.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
As the squad approaches the selected position, the SL: Directs No. 1 to act as ground guide in emplacing the system. Directs No. 2 to move vehicle into position as directed by No. 1. Directs No. 3 to select a squad command post at least 200-300 feet to the rear of the vehicle. Directs No. 4 to select an observation post at least 200-300 feet forward of the vehicle.				
Selects a spot near the proposed emplacement site. Designates the spot to No. 2, commands, HALT VEHICLE, at the selected spot.				
Commands, DISMOUNT, and dismounts from right vehicle door.				
Directs all operations and provides security against possible ground or air attack.	Dismounts from right vehicle door, moves to selected emplacement site.	Halts vehicle at the exact spot designated by the SL. Sets brakes and keeps the engine running.	Dismounts from right vehicle door.	Dismounts from right vehicle door.
		Assumes duty of maintaining communications with platoon headquarters.	Examines area 200-300 feet in the rear of the emplacement site and selects a command post.	Examines area 200-300 feet in front of the emplacement site and selects an observation post.
	Acts as guide in moving system into location.	Moves vehicle to emplacement site as directed by No. 1.	Returns to the vehicle and reports location of the command post to the SL.	Returns to the vehicle and reports the location of the observation post to the SL.
When the Chaparral system is emplaced and personnel posts are selected, commands, FALL IN.	Falls in on spot designated by the squad leader.	Shuts off engine.	Falls in and dresses on No. 1	Falls in and dresses on No. 3.

Designates posts, primary target line, reference point, search sectors, and primary field of fire. Explains tactical situation and gives instructions regarding local security.				
Commands, PREPARE FOR ACTION.	Falls out and moves to the rear of vehicle, verifying that UPLOCK LEVER is in the UNLOCK position as he passes it.	Transfers communications and security responsibilies to the squad leader.	Falls out and double times to the rear of the vehicle.	Falls out.
Monitors vehicle communications, assumes duty of local security, and supervises the squad.				
	Assisted by No. 3, lowers vehicle tailgate.	Dismounts and, assisted by No. 4, checks the radiator water level, and the oil level of the engine, transmission, differential, and final drives.	Assists No. 1 in lowering the vehicle tailgate.	Assists No. 2 in performing after-operation checks.
		Assisted by No. 4, unfolds and latches blast covers into firing position.		Assists No. 2 in unfolding and latching the blast covers into firing position.
	Energizes the battery heater, if required.	Closes left cab door.		
	Opens rear electrical compartment access door.	Checks the tracks and road and idler wheel oil levels.		
	Checks to insure battery charge indicator reads in the yellow zone.			
	Sets PRIME POWER rotary switch to MANUAL.			
	During the 1-minute purging period, sets MASTER POWER Switch to ON. Sets and holds LAMP TEST switch to ON. Observes that all lamps are lit. Releases switch.			
	Verifies the ERECT/RETRACT circuit breaker is ON. Erects mount approximately 2 inches to insure the battery charge indicator needle does not dip into the red zone.			
	Closes rear electrical compartment access door.			

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SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
	Steps up on launching station deck, opens canopy, enters gunner's compartment, closes canopy, and checks for light leakage.		Energizes main power unit (MPU) by pressing and holding the push-to-start button until MPU starts.	
	Puts on gunner's headset, rotates gunner's sight into position, adjusts sight reticle illumination, and adjusts gunner's seat.			
	On the center control panel, verifies TRIGGER LOCK switch is turned to OFF and the key is out.			
	Sets the POWER SUPPLY, MOUNT DRIVE, and MOUNT CONDITIONING circuit breakers to ON.			
	Sets the MOUNT POWER switch to ON. Sets the MOUNT CONDITIONING and BLOWER switches as desired.	After above checks are completed, reports, VEHICLE READY.		
	Sets BRIGHT/DIM switch to BRIGHT. Verifies lamps brighten. Sets BRIGHT/DIM switch to DIM.		Sets and holds mount ERECT/OFF/RETRACT switch at ERECT until mount is fully erected. Releases switch.	Sets UPLOCK LEVER to the LOCK position.
	Observes that the MOUNT STRUCTURE interlock lamp is out. Sets and holds LAMPS TEST switch to TEST. Verifies all lamps are lit. Releases LAMPS TEST switch.	Assists squad leader in providing local security.		Opens crew equipment compartment and obtains two TA-312/PT telephone sets, one C-2328/VRC GRA 39 remote control unit, one TADDS unit, two pairs of binoculars, and three reel units of DR/8 field wire from the crew equipment compartment.
	Turns COMMUNICATIONS rotary switch to INTERCOM AND RADIO RCVR. Verifies that the radio can be heard through the gunner's headset (rushing noise).		Steps up on launching station deck, checks condition of missiles, checks that safety streamer pins, wings, and fins are securely attached.	Places one telephone set, one reel unit with field wire, and one set of binoculars on the side of the launching station deck (left or right side can be designated by the leader).
	Directs No. 3 to remove missile dome protective covers, rolleron protective covers, and safety pins and streamers from each launch rail.		Removes missile dome protective covers, rolleron protective covers, and safety pins and streamers as directed by No. 1. Places them in the vehicle cab.	
	Performs missile preoperational checks as follows:			

streamers from each launch rail

and safety pins and streamers as directed by No. 1. Places them in the vehicle cab.

Verifies ARM switch is OFF. Turns MODE selector switch to TEST. Observes that one MISSILE SELECTION lamp lights. Cycles SEQUENCE ADVANCE switch three times; observes that the three remaining lamps light.			
Instructs No. 3 to replace safety pins and streamer pins, unless actual battlefield condition exists.		Replaces safety pins and streamer, unless actual battlefield condition exists.	Places one telephone set, TADDS unit, remote control unit, two reel units with field wire, and one set of binoculars on the launching station deck (left or right side can be designated by SL).
	Obtains one TA-312/PT telephone set and one set of binoculars; takes them to the forward observation post.	Determines that there is no background IR source.	
Directs No. 3 to hold the IR flashlight approximately 1 foot in front of and off center of each missile seeker and monitors missile tone of each seeker.		When directed by No. 1, holds IR flashlight approximately 1 foot in front of and off center of missile seeker selected by No. 1.	Closes crew equipment compartment.
Sets MISSILE CAGE/UNCAGE switch at UNCAGE and checks that missile tone nulls (MIM-72A & B), and that missile tone does not null for the MIM-72C (Improved).			
Opens canopy, checks that the launching station deck is clear, closes and latches canopy.		Steps down from launching deck, turns PRIME POWER rotary switch to AUTO.	Steps down from launching station deck.
		Assisted by No. 4, closes and latches tailgate.	Assists No. 3 in closing tailgate.
Verifies both action switches operate by pressing each switch and rotating the hand control, observing the DRIVE SYSTEM warning lamp goes out, the mount traverses, and the launch rails elevate and depress.		Reports, MISSILES READY.	Connects wires to appropriate INTERCOM terminals and RADIO terminals.
			Reports, COMMUNICATIONS READY.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
After receiving reports from all squad members, transfers commo to NO. 1.	Reports LAUNCHING STATION READY.		Obtains two reel units of field wire and one TA-312/PT telephone set. Lays wire to the squad command post.	Obtains one reel unit of field wire from the launching station deck and lays wire to the forward observation post.
Closes right cab door.	Assumes communications.			
Obtains remote control unit, the TADDS unit, and one set of binoculars from the launching station deck. Takes them to command post.	Conducts a communications check with the forward observation post and squad command post.	Conducts a communications check with No. 1 and the squad command post.	Connects INTERCOM wires to the telephone set and conducts a communications check with the senior gunner and the forward observation post.	Connects field wire to the TA-312/PT telephone set.
Connects RADIO wire to the remote control unit and conducts a communications check with platoon headquarters.				Reports to No. 2 that he is ready for action.
Emplaces and orients the TADDS unit to magnetic north and plots the fire unit and FAAR unit prositions on the TADDS matrix.				
Assumes communications.	Transfers communications to SL.			
Records azimuth indicator reading of reference point as reported by No. 1.	Reports the azimuth indicator reading of the reference point to the squad leader and the forward observation post.	Records the azimuth indicator reading of the reference point as reported by No. 1.		
Notifies No. 1 of the mode to use.	Turns MODE selector switch to mode selected by the squad leader.			
	Reports to the squad leader over the intercom, SYSTEM READY FOR ACTION.			
Commands squad to begin search and scan of their assigned sectors of search.		Begins search and scan procedures of assigned sector alternating with No. 4.	Begins search and scan procedures of assigned sector alternating with the squad leader.	Begins search and scan procedures of assigned sector alternating with No. 2.
Reports to the platoon headquarters, SQUAD READY FOR ACTION.				

EMERGENCY EMPLACEMENT.

This sequence is used for rapid emplacement from a march column when RSOP and full emplacement are not feasible.

Commands, EMERGENCY EMPLACEMENT, directs No. 2 to move the vehicle to a desginated spot.		Drives to position designated by SL.		
Dismounts.	Dismounts.	Dismounts.	Dismounts.	Dismounts.
Maintains radio communications from the right of cab.	Assisted by No. 3, unlocks and lowers tailgate. Sets MASTER POWER switch and ERECT/RETRACT BREAKER to ON. Turns PRIME POWER switch to AUTO. Closes and latches tailgate.	Assisted by No. 4, unfolds and latches blast covers. Closes left cab door.	Assists No. 1.	Assists No. 2.
Commands Nos. 2 & 4 to proceed to the observation post and furnish ground security for the squad.	Climbs on the launching station deck. Enters the mount. Energizes the control panels. Erects the mount and adjusts the sight.	Accompanied by No. 4, goes to the observation post and prepares to defend the Chaparral position.	Sets UPLOCK LEVER to LOCK.	Goes to observation post with No. 4.
Transfers communications to No. 1.	Assumes communications.			
Closes right cab door.			Climbs up on launcher deck.	
			Removes dome covers, safety pins and streamers from missiles.	
			Opens equipment compartment and removes a telephone and reel of wire.	
			Closes and latches compartment door.	
			Climbs down to ground.	
Connects end of field wire to external intercom binding posts and lays wire to the command post. Connects telephone and establishes communications with No. 1.	Inserts key in TRIGGER lock.	Searches for air and ground targets.	Searches for air and ground targets.	Searches for air and ground targets.
Observes that Nos. 2, 3, & 4 are at their action posts.	Notifies SL that he is ready for action.			
Reports to PL, SQUAD_____ READY FOR ACTION.				

TARGET ENGAGEMENT

This drill describes the procedures used by the squad to search for and engage targets. The drill is based on the weapon being emplaced and prepared for action, weapons control status weapons tight in effect, and communications nets operational.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Maintains communications with platoon hq, No. 1, and the OP.	Turns MODE switch to READY.		Monitors auxiliary receiver and reports intelligence to SL.	
Directs all squad activities.	Maintains communications with SL and OP.			
Conducts search and scan, alternating with No. 3.	Maintains surveillance along primary target line.	Maintains surveillance, alternating with No. 4.	Maintains surveillance of assigned sector, alternating with SL.	Maintains surveillance of assigned sector, alternating with No. 2.
Monitors TADDS for early warning of approaching aircraft.	Monitors control panels for system malfunction.			
Alerts the squad to the approach of a potential target by relaying target azimuth to Nos. 1 and 2.				
Directs squad to commence search along the expected route of approach.	Searches the sky along the expected azimuth of approach, with occasional all-around search to avoid undetected approach of another aircraft.			
Directs No. 1 to turn MODE switch to OPR and set ARM switch at ARM.	Turns MODE switch to OPR and sets ARM switch at ARM.	When the target is sighted, the observer sighting the target reports to SL, TARGET, ____ O'CLOCK, (HIGH, LOW). Other observers return to search of their own assigned sectors.		
Searches the sky along the approach azimuth.	The observer reporting the target will continue to call out the target position until the SL notifies that he has sighted the target.			

TARGET ENGAGEMENT

The following steps are based on an air defense warning RED and weapons control status of weapons tight.

Searches the azimuth reported by the observer.	Slews the mount to the direction of approach and searches for the target.		
When he sights the target, announces, CONTACT.			
Repeats target location to No. 1.	When target is sighted, announces, CONTACT, to SL.	Nos. 2, 3, and 4 resume search of their assigned sectors.	
Identifies target and, if single and hostile, commands, HOSTILE, (azimuth), (HIGH, LOW), SHOOT-LOOK-SHOOT, ENGAGE.			
	Centers the target in sight reticle. Tracks the target for the best IR tone. When tone is received, announces, TONE, over intercom.		
	When he has a good missile tone, sight picture, and no HOLD FIRE lamp lit, launches the basic missile.		
	Ignores HOLD FIRE lamp for IMPROVED MISSILE.		
Observes the missile flight. When missile explodes, determines target damage. If target is not destroyed, commands, No. 1, FIRE TWO.	Reacquires target as rapidly as possible and prepares to fire a second missile, if required.		
When target is destroyed, commands, ABANDON.	Returns to assigned sector or primary target line.		

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Target Engagement, Multiple Targets. The following steps are based on an air defense warning RED and weapons control status of weapons tight.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Searches the azimuth reported by the observer.	Slews the mount to the direction of approach and searches for the target.			
When he sights targets, announces, CONTACT, to observers.	When he sights targets, announces CONTACT, to observers.			
Identifies target and if hostile, commands, HOSTILE, (azimuth),, (HIGH, LOW), (FRONT-TO-REAR, REAR-TO-FRONT) SHOOT-NEW TARGET-SHOOT. (BASIC, IMPROVED) ENGAGE.		Nos. 2, 3, and 4 resume search of their assigned sectors.		
	Centers a target in sight reticle.			
	Tracks target for best IR tone; when tone is received, announces, TONE, over intercom.			
	Checks for no HOLD FIRE lamp lit.			
	When good missile tone is heard and HOLD FIRE lamp is out, launches missile. (Ignores lamp for improved missile).			
	Acquires a new target and repeats steps above.			
Assesses target damage; orders CEASE FIRE when targets are destoryed or out of range.				
	Returns to assigned search sector or to primary target line.			

POST-ACTION DRILL

General. After completing an engagement, it may be necessary to displace Chaparral to an alternate position to avoid being targeted by enemy ground fire or attacked by hostile aircraft. If a move of considerable distance is required and time and the tactical situation permit, the displacement should be conducted as described below. If the tactical situation is urgent and displacement must take place immediately, the procedure described in Emergency Displacement should be followed.

Normal Displacement. This drill procedure is based on the squad members being located at their tactical positions. The squad leader will order the displacement upon receipt of orders from platoon headquarters. Normal displacement drill is outlined as follows:

Using the intercom, commands, MARCH ORDER.				
Closes and secures TADDS.	Sets and holds LOAD/OFF/STOW switch at stow until mount is positioned at 6 o'clock and the launch rails at 0°.	Disconnects field wire from telephone.	Disconnects field wire from telephones.	Carries the telephone and binoculars to the vehicle.
Disconnects field wire from remote control unit.			Returns to the vehicle and places telephones on the launching station deck.	
Carries binoculars, TADDS, and remote control unit to the weapon.		Returns to the vehicle, reeling the field wire.	Opens tail gate, assisted by No. 4.	Assists No. 3 in opening tailgate.
	Stows the sight; turns TRIGGER lock switch to OFF.	Disconnects the field wire from the external communications panel and places the reel on the launching station deck.	Reels up the three reels of field wire, disconnects them from the external communications panel, and places them on launching station deck.	Climbs on to launching station deck, opens crew equipment compartment.
Reestablishes radio communications with platoon headquarters, using the vehicle cab communications.	Removes key.	Assisted by No. 3, stows blast shields.	Assists No. 2 in stowing blast shields.	Removes the missile dome protectors and lays them on the deck. Set UPLOCK LEVER to UNLOCK.
Acts as local security while the squad is preparing for march order.	Removes and stows the gunner's headset.	Performs before-operation checks on the vehicle.		As the SL, No. 2, and No. 3 return equipment, stows it in the crew equipment compartment.
		Reports, VEHICLE READY.	Assists No. 4 in stowing equipment.	
				Closes and latches the compartment doors and notifies No. 1 that the launching station deck is clear.
				Reports, EQUIPMENT READY.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
	Verifies that UPLOCK LEVER is at UNLOCK.			
Receives reports from squad as their tasks are completed.	Sets and holds the ERECT/OFF/RETRACT switch at RETRACT until mount is fully retracted.			
	Opens canopy, dismounts, closes, and latches canopy.			
	Replaces missile dome protectors.			
	Assisted by No. 3, raises and locks vehicle tailgate.		Assists No. 1 in raising and locking tailgate.	
	Reports, MOUNT READY.			
When the squad has reported ready, commands, MOUNT.				
	Mounts cab through right door after No. 3.	Mounts cab through left door and puts on headset.	Mounts cab through right door after No. 4.	Mounts cab through right door.
When No. 2 has mounted, transfers communications to No. 2.		Starts engine, reports, READY.		
Inspects Chaparral to insure that all equipment is secured.				
Mounts cab through right door, takes over communications.		Returns communications to SL, takes off headset.		Puts on headset and monitors the R-442/VRC.
When engine is started, commands, MOVE OUT.				
Directs No. 2 in operating the vehicle.		Drives Chaparral over the directed route.		

EMERGENCY DISPLACEMENT.

If the firing of missiles during an engagement discloses the location of the position and draws enemy fire, the squad may have to displace immediately. In this case the emergency displacement should be conducted as follows:

Using the intercom, commands, EMERGENCY MARCH ORDER.				
Orders communications lines cut if necessary.	Turns MODE switch to STANDBY.	Returns to vehicle at double time, carrying binoculars and telephone.	Returns to vehicle at double time, carrying field telephones.	Recovers as much wire as time permits, cuts wire and returns to vehicle, and places reel unit in vehicle cab.
Returns to the vehicle at double time, carrying TADDS, remote control unit, and binoculars.	Remains in mount during displacement.	Places equipment in vehicle cab.	Recovers as much wire as time permits, cuts wire and returns reel units to the vehicle cab.	
Orders stowage of the required blast shields.	Scans area for indications of a probable ground attack.	Stows the required blast shields assisted by Nos. 3 and 4. Takes driver's position in cab.	Assists No. 2 in stowing required blast shields.	Assists No. 2 in stowing blast shields.
			Verifies that UPLOCK LEVER is at LOCK.	
		Starts engine.	Climbs on launching station deck to secure equipment during travel.	Climbs on launching station deck to secure equipment during travel.
Establishes communications with platoon headquarters when squad is loaded.			Scans the area for indications of a probable ground attack.	Scans the area for indications of a probable ground attack.
Directs No. 2 to alternate position.		When directed, moves vehicle and drives to new location.		

MISSILE LOADING

As soon as possible after an engagement, the empty rail should be loaded.

Note. The missile weighs 190 pounds and requires four men to handle and support when the missile case clears the storage bin.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Commands, MISSILE LOADING, FALL IN.	Falls in 1 meter behind the left vehicle track.	Falls in, dressing on No. 1.	Falls in, dressing on No. 2.	Falls in, dressing on No. 3.
Designates the missile to be loaded. Designates the rail to be loaded. Commands, MISSILE LOAD.				
Supervises and directs the loading procedures, assisting as required.	Falls out and, assisted by No. 2, lowers vehicle tailgate.	Falls out and assists No. 1 in lowering tailgate.	Falls out, opens fin storage compartment, and removes the safety pins and streamers and hands them to NO. 2.	Falls out, opens the storage bin containing the missile to be loaded.
	Energizes prime-power subsystem and conditions the mount for loading.	Climbs on launching station deck, opens umbilical latch access door on launch rail to be loaded, removes sheared cable, if any.	Removes rail cleaning equipment and places it on launching station deck.	Disconnects heater cable between the missile case and storage compartment.
	Sets MASTER POWER switch at OFF and observes that the MASTER POWER lamp goes out.	Inspects launch rails, cleans them if needed.	Removes required wings and fins from storage and places them on the blast shields.	
		Installs safety pins and streamers on all launch rails.	Removes the required tools and places them on launching station deck.	
		Verifies that detent pins on empty rails are in the retracted position.	Climbs on launching station deck and assists No. 2 as required.	
Positions himself to assist in lifting and guiding the missile onto the launch rail.	Takes position in front of storage bin containing missile to be loaded.	Climbs down and takes a position behind No. 1.	Climbs down and takes a position behind No. 2.	

Cautions squad to be prepared to take weight of missile as it clears the storage bin.	Assists No. 4 in pulling missile case out until warning stripe appears.			Assisted by No. 1, grasps the extractor handle and pulls the missile case out of the storage bin until the warning stripe is exposed.
	Assists Nos. 2, 3, and 4 in removing the missile case from the storage bin.	Assists Nos. 1, 3, and 4 in removing the missile case from the storage bin.	Assists Nos. 1, 2, and 4 in removing the missile case from the storage bin.	When Nos. 1, 2, and 3 are in position, removes missile case from the storage bin.
		Releases case clasps and helps remove the case lid.	Releases case clasps and helps remove the case lid.	
Assists in removing missile from its case and supporting its weight.	Assists SL and NOs. 2 and 3 support the missile.	Assists in removing the missile from its case.	Assisted by SL and Nos. 1, 2, and 4, removes the missile from its case.	Assists in removing the missile from its case.
Disconnects the heater cable from the umbilical cable and stores it in the case.	Climbs to the launching station deck and verifies that the umbilical assembly access door is open.			
Assists in supporting the missile while it is being engaged to launch rail.	Guides the missile and engages the hanger lugs.	Assists in supporting the missile while it is being engaged to launch rail.	Assists in supporting the missile while it is being engaged to launch rail.	Assists in supporting the missile while it is being engaged to launch rail.
Supervises the squad.	Pushes the missile against the butt plate to engage the rear snubber and detent pin.	When missile is supported by the rail, climbs on the launching station deck.	When missile is supported by the rail, climbs on the launching station deck.	When missile is supported by the rail, climbs on the launching station deck.
	Checks for proper detent pin engagement.	As No. 3 attaches wings, uses the torque wrench to secure retaining screws.	Attaches the wings (the rolleron wings are attached opposite each other).	Attaches control fins to the missile. Attaches retainers on basic missile.
	Engages umbilical retractor assembly and connects umbilical cable to the launch rail umbilical connector.	Returns the torque wrench to the wing and fin compartment door.		
Checks that missile is properly loaded and empty missile case is returned to the storage bin.	Checks that wings and control fins are properly installed, rolleron protectors are off, and missile dome protectors are on.	Assists No. 4 in closing the missile case and returning it to the storage bin.		Closes the empty missile case and returns it to the storage bin, assisted by No. 2.

Note. The entire procedure listed above will be repeated for each missile to be loaded. The loading drill should be practiced until the crew can load four missiles in 8 minutes or less. This time does not include missile checkout. When all missiles have been loaded, the following steps will be performed.

	Assisted by No. 2, closes tailgate.	Assists No. 1 in closing tailgate.		
Assumes dismounted post.	Assumes dismounted post.	Assumes dismounted post.	Assumes dismounted post.	Assumes dismounted post.
Reports to PL, SQUAD—— MISSILES LOADED.				

MISSILE UNLOADING

To control gyro running time on the missiles carried, the missiles are rotated periodically from storage to the launch rails. This requires that missiles be unloaded from the rails. Missile unloading is performed one missile at a time in the following sequence:

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Commands MISSILE UNLOAD, FALL IN.				
Desginates missile to be unloaded and the storage bin in which it will be placed.	Falls in 1 meter behind the left vehicle track.	Falls in, and dresses on No. 1.	Falls in, and dresses on No. 2.	Falls in, and dresses on No. 3.
Commands, UNLOAD.				
Supervises the unloading, assisting as required.	Falls out and, assisted by No. 2, lowers tailgate.	Falls out and assists No. 1 in lowering tailgate.	Falls out, opens fin storage compartment, removes torque and Allen wrenches.	Falls out and opens door of missile storage compartment designated by SL.
	Energizes the launching station and conditions the mount for unloading.		Assists No. 4 in removing the missile case from storage and placing it on the ground.	Grasps the extractor handle and pulls the missile case out of the compartment.
	Climbs on the launching station deck.	Climbs on the launching station deck.	Unlocks the case clasps, removes the lid, and places it on the ground.	Climbs on the launching station deck.
	Opens umbilical assembly door and disconnects the cable.	Obtains the torque wrench, removes the missile wings and hands them to No. 3.	Takes wings and fins and stores them in the storage compartment.	Obtains the Allen wrench, removes the control fins and hands them to No. 3.
	Obtains the detent latch lever and rotates the detent pin to the retracted position.			
	Slides missile along hangers.	Slides missile along hangers.	Helps support missile as it slides off hanger.	Climbs down to tailgate and helps support missile.
	Helps support missile as it slides off hangers.	Helps support missile as it slides off hangers and climbs down to tailgate.		Climbs down to ground while helping to support missile.
	Climbs down to tailgate and ground while helping support missile.	Climbs down to ground while helping to support missile.		
Connects heater cable to umbilical cable.	Helps carry missile to case and put it in.	Helps carry missile to case and put it in.	Helps carry missile to case and put it in.	Helps carry missile to case and put it in.

	while helping support missile	to support missile.		
Supervises the squad and assists as needed.	Opens missile storage bin door.	Helps put lid on case and fasten clamps.	Helps put lid on case and fasten clamps.	
	Helps pick up missile, carry it to, and guide it into storage bin.	Helps pick up missile, carry it to, and insert it into storage bin.	Helps pick up missile carry it to, and inset it into storage bin.	Helps pick up missile carry it to, and insert it into storage bin.
	Closes and fastens storage bin door.			
Note. The entire procedure listed above will be repeated for each missile unloaded.				
	Assisted by No. 2, closes tailgate.	Assists No. 1 in closing tailgate.		
Assumes dismounted post. Reports to PL, MISSILES UNLOADED.	Assumes dismounted post.	Assumes dismounted post.	Assumes dismounted post.	Assumes dismounted post.

INSTALLATION OF SWIM KIT

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Commands, INSTALL SWIM KIT.				
Supervises the squad. Assists when necessary.	Assisted by No. 3, lowers tailgate and inspects the seal between the hull and tailgate.	Assisted by No. 4, inspects access plates in hull for a snug fit and that seals are in place; checks bilge pumps for proper operation; and checks the track shrouds for proper installation.	Assists No. 1. Slides out right storage tray and removes the end beam and 2 brackets, 2 tailgate curtain strips and 10 screws and washers, and lays them on the deck.	Obtains necessary tools from storage and places them on the deck.
	Slides out left storage tray, removes the flotation curtain and stanchions, and places them on the deck.			
Assists No. 1.	Assisted by No. 3, installs stanchions and end beam.	Assisted by No. 4, removes the end, side, and tailgate.	Assists No. 1.	Assists No. 2.
	Assisted by SL and Nos. 2 and 3, unfolds flotation curtain and inspects for cracks or holes. Checks the rope looped through the holes at top of curtain.	Assists No. 1.		Climbs onto the launching station deck and prepares to hang the flotation curtain.
	Assisted by SL and Nos 2 and 3, positions the curtain around the hull, starting at the right front corner of the launching station.			As the rest of the squad positions the curtain, hangs a loop of rope over alternate stanchions and the end beam to support the curtain.
	Starting at the right front corner of the launching station deck (rear of the engine), alines the holes in the curtain, end piece, and hull, and inserts the screws.	Assists in alining holes in the flotation curtain, end piece, and hull.	Tightens the mounting screws.	
	Assisted by No. 3, attaches side strips, tailgate strips, and final end strip (left front), and tightens the screws.	Assists No. 4 in drawing the curtain taut (vertically) as Nos. 1 and 3 attach mounting strips.	Assists No. 1.	Assisted by No. 2, draws the curtain taut (vertically), loops and tightens the rope over each stanchion and tightens the loops on the end rail. The slack rope is taken up at the right rear, left rear, and left front corners of the curtain. Secures ends of ropes.
	Obtains the exhaust extension from its storage place. Assisted by No. 3, removes the regular extension and attaches the swim kit extension.	Checks hull access cover, drain covers, and recess drain plugs. Checks fuel cover gasket.	Climbs onto the engine grill and assists No. 1 in exchanging the exhaust extensions. Stows regular extension.	

Inspects the Chaparral swim kit.	[illegible]		[illegible]	Secures the tools.
Takes mounted position in cab.	Take[illegible]	Takes mounted position in cab.	[illegible]	Takes mounted position in cab.
Reports to PL, SQUAD ____ READY.				

REMOVAL AND STORAGE OF SWIM KIT

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Commands, REMOVE AND STORE SWIM KIT.				
Supervises the squad, assisting as necessary.	Assisted by No. 3, removes the end, side, and tailgate mounting strips and lays them on the deck.	Assisted by No. 4, inspects vehicle for damage, and checks operation of bilge pumps.	Obtains necessary tools and assists No. 1.	Assists No. 2.
Slides out left storage tray. Places the folded curtain and 12 stanchions in tray.	Assisted by No. 3 shakes water from the flotation curtain.			Climbs on the deck and unhooks the rope as others fold the curtain.
Assists No. 1.	Assisted by SL and Nos. 2 and 3, folds the flotation curtain, keeping the adhesive strip clear of the ground. Places the folded curtain on the launching station deck.	Assists No. 1.	Assists No. 1.	
	Removes the stanchions from their emplaced positions. Lays them on the deck.	Replaces side and end strips using the existing hardware (30 screws and washers).	Dismantles the end beam and mounting brackets; lays them on the deck.	Assists No. 2.
	Assisted by No. 3, lowers tailgate.		Assists No. 1 in lowering tailgate.	
Inspects the Chaparral for correct storage of equipment.		Assisted by No. 3, replaces tailgate strips.	Slides out right storage tray. Places the end beam, 2 rear beam brackets, 2 tailgate curtain strips, and 10 screws and washers in storage tray.	Assists No. 1.
	Assisted by No. 3, closes the storage trays and tailgate.	Stores the tools.	Assists No. 1 in closing storage trays and tailgate.	
Assumes mounted post in vehicle.	Assumes mounted post in vehicle.	Assumes mounted post in vehicle.	Assumes mounted post in vehicle.	Assumes mounted post in vehicle.

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APPENDIX A

REFERENCES

AR 385-62	Regulations for Firing Guided Missiles and Heavy Rockets for Training, Target Practice and Combat
DA Pam 108-1	Index of Army Motion Pictures and Related Audio-Visual Aids
FM 21-6	How to Prepare and Conduct Military Training
FM 44-1	US Army Air Defense Artillery Employment
FM 44-3	Air Defense Artillery Employment: Chaparral/Vulcan
FM 44-16P	Soldier's Manual, Short Range Air Defense Artillery Missile Crewman
FM 44-20	Service Practice for Air Defense Artillery Units
FM 44-23	US Army Air Defense Employment, Redeye
FM 44-23-1	Operations and Training, Redeye
FM 44-102	Procedures for Ballistic Aerial Target System
TM 9-1300-206	Ammunition and Explosive Standards, Aug 73.
TM 9-1410-585-24	Organizational, DS and GS Maintenance Manual, Chaparral Intercept Aerial Guided Missile MIM-72A and MIM-72B, Chaparral Training Missile M30, (U)
TM 9-1425-586-10	Operator's Manual, Chaparral M48, Intercept-Aerial Guided Missile System
TM 9-6920-585-12	Operator and Organizational Maintenance Manual, Monitoring Set, Guided Missile System, Training, AN/TSQ-T3 (XO-2)
TC 21-5-3	TEC Management Instruction
TC 21-5-7	Training Management in Battalions
TC 44-1-1	Air Defense Artillery Survivability
TC 44-1-2	ELSEC for Air Defense Artillery Radars (U)
TC 44-3-1	Training Chaparral/Vulcan Batteries in Reconnaissance, Selection, and Occupation of Position
TC 44-30	Aircraft Recognition Training for Ground Observers

APPENDIX B

TEC LESSONS

043-441-1012-F	Chaparral/Vulcan Communications and Methods of Control
043-441-1015-F	TADDS Emplacement & March Order
043-441-1016-F	TADDS Operational Checks
043-441-1017-F	TADDS Operation
043-441-1018-F	TADDS Maintenance
043-441-1045-F	Chaparral/Vulcan Tactics RSOP, Part 1
043-441-1046-F	Chaparral/Vulcan Tactics RSOP, Part 2
043-441-7801-F	Chaparral Pre-energizing, De-energizing
043-441-7803-F	Chaparral Energizing Checks, Part 1
043-441-7804-F	Chaparral Energizing Checks, Part 2
043-441-7805-F	Chaparral Daily Maintenance Checks, Part 1
043-441-7806-F	Chaparral Daily Maintenance Checks, Part 2
043-441-7807-F	Chaparral Daily Maintenance Checks, Part 3
043-441-7806-F	Chaparral Daily Maintenance Checks, Part 4
043-441-7809-F	Chaparral Daily Maintenance Checks, Part 5
043-441-7810-F	Chaparral Daily Maintenance Checks, Part 6
043-441-7811-F	Chaparral Daily Maintenance Checks, Part 7
043-441-7812-F	Chaparral Daily Maintenance Checks, Part 8
043-441-7813-F	Chaparral Daily Maintenance Checks, Part 9
043-441-7814-F	Chaparral Weekly Maintenance Checks, Part 1
043-441-7815-F	Chaparral Weekly Maintenance Checks, Part 2
043-441-7816-F	Chaparral Weekly Maintenance Checks, Part 3
043-441-7817-F	Chaparral Weekly Maintenance Checks, Part 4
043-441-7818-F	Chaparral Weekly Maintenance Checks, Part 5
043-441-7819-F	Chaparral Weekly Maintenance Checks, Part 6
043-441-7830-F	Chaparral Cold Weather Checks

043-441-7836-F	Preparing The Chaparral for Action
043-441-7838-F	Chaparral Engagement of Aerial Targets, Part 1
043-441-7839-F	Chaparral Engagement of Aerial Targets, Part 2
043-441-7840-F	Chaparral Engagement of Aerial Targets, MIM-72C
043-441-7842-F	Load/unload The Chaparral Missile, Part 1
043-441-7843-F	Load/unload The Chaparral Missile, Part 2
043-441-7844-F	March Order The Chaparral
043-441-7845-G	Preparing The Chaparral For Swimming
920-061-0550F	Introduction to TEC
920-777-0505-F	TEC For Green Tabbers
920-777-0505-A	TEC For Green Tabbers

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FM 44-4

29 JUNE 1979

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

DISTRIBUTION:

Active Army and USAR: To be distributed in accordance with DA Form 12-11B, Requirements for Procedures and Drills for Chaparral Air Defense Guided Missile System (Qty rqr block no. 353).

ARNG: None.

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FM 44-4

Field manual 44-4

Change
No. 1

C1, FM 44-4

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HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 16 December 1981

OPERATIONS AND TRAINING
CHAPARRAL

FM 44-4, 29 June 1979, is changed as follows:

1. Remove old pages and insert new pages as indicated:

Old Pages	New Pages
iii, iv, v	iii, iv, v
1-1 through 1-6	1-1 through 1-6
1-15 through 1-17	1-15 through 1-17
2-5, 2-6	2-5, 2-6
2-9	2-9 through 2-14
3-1 through 3-18	3-1 through 3-19
7-21	7-21 through 7-23
8-5 through 8-8	8-5 through 8-8.2
8-11 through 8-14	8-11 through 8-14
A-1	A-1, A-2

2. New or changed material is identified by a bar opposite the change.

3. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

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PREFACE

OPERATIONS and TRAINING CHAPARRAL

This field manual provides a brief description of the characteristics and capabilities of the Chaparral weapon system. It discusses the tactical use and employment of the system and the training of the crew.

The guidelines for the tactical employment of the basic Chaparral missile (MIM-72A) as stated in FMs 44-1 and 44-3 are also valid for the improved Chaparral missile (MIM-72C). The technique of fire for both Chaparral missiles is as stated in this field manual. A detailed description of the basic and improved missiles can be found in (C) TM 9-1410-585-24 and (C) TM 9-1410-586-24, respectively.

This manual focuses on the techniques and procedures used by the Chaparral squad to attack and destroy hostile targets. It consists of two parts:

PART I describes the Chaparral weapon system and tells how the squad uses it to engage enemy targets.

PART II discusses means available and techniques that are used to train the Chaparral squad to operate its weapon system.

This manual should be used with the system technical manual (TM 9-1425-1586-10) which tells how Chaparral works and how to maintain it. Information found in the technical manual, such as energizing and maintenance, is not repeated in this manual.

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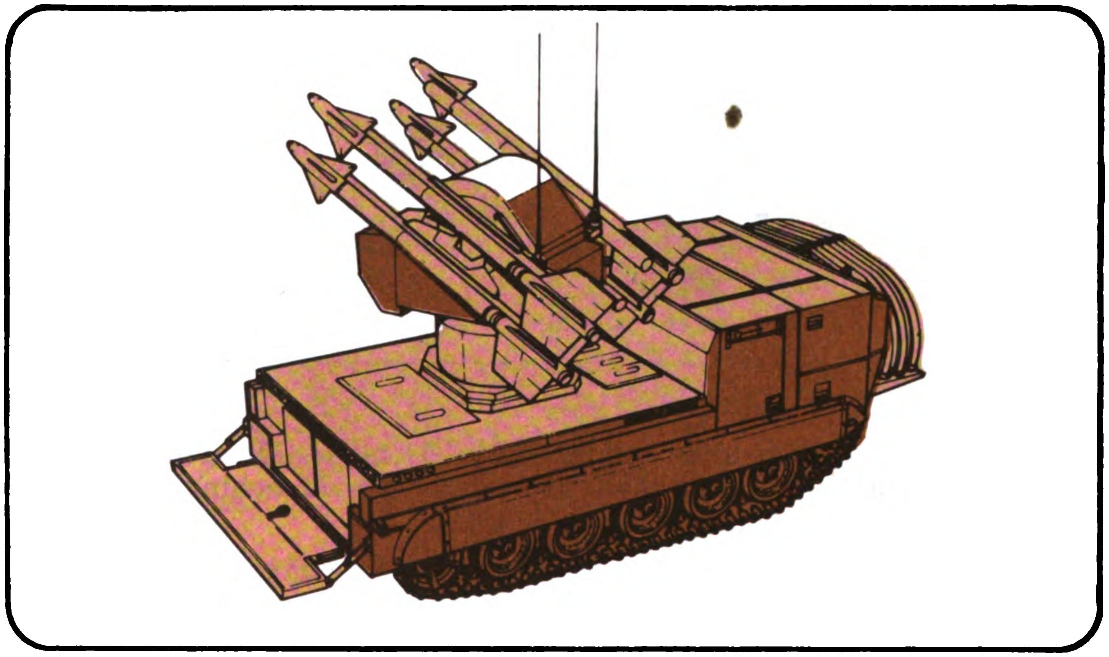
PART I

THE CHAPARRAL GUIDED MISSILE SYSTEM AND HOW TO USE IT

CHAPTER 1

DESCRIPTION OF THE CHAPARRAL SYSTEM



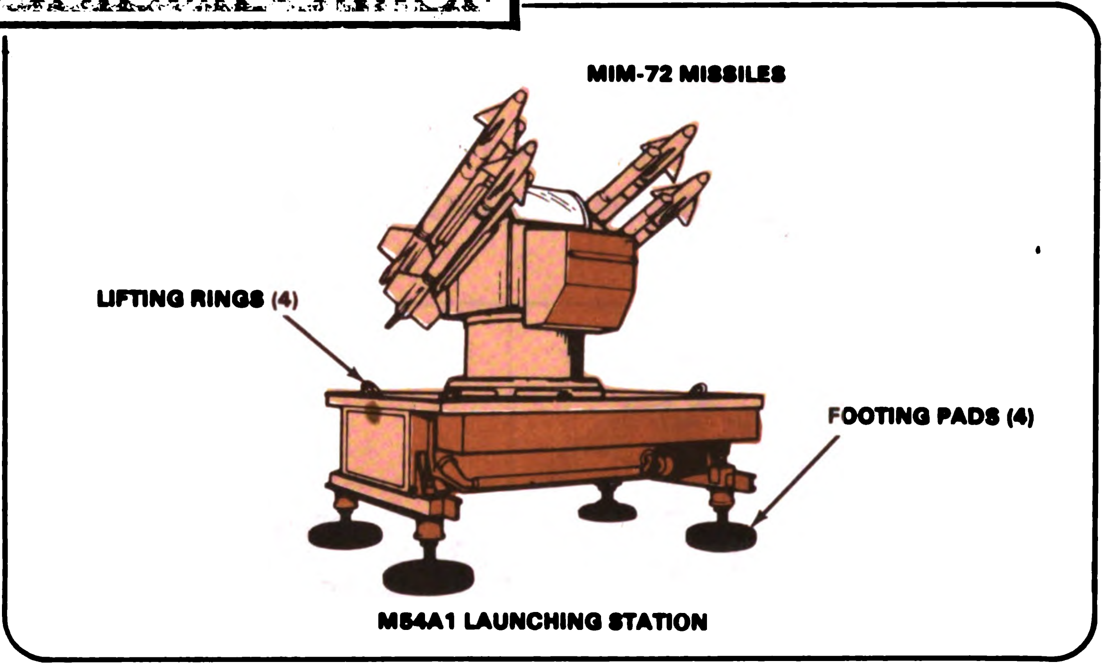
The Chaparral system (guided missile system, intercept-aerial,carrier mounted, M48) consists of a launching station (M54) mounted on a full-tracked carrier (M730). If equipped with identification, friend or foe (IFF) equipment, the Chaparral system and launching station are designated M48A1 and M54A1, respectively. The system fires Chaparral guided missiles MIM-72A and MIM-72C.

Chaparral is a self-propelled, surface-to-air, guided missile system fielded to protect the forward area against low-flying enemy aircraft. Visual target detection and tracking are required for conduct of effective fire by the Chaparral.

Chaparral is found in the Chaparral/Vulcan battalion of armored, mechanized infantry, and infantry divisions; and in nondivisional Chaparral/Vulcan battalions. The Chaparral is manned by short-range air defense missilemen in MOS 16P (10-30).

This chapter provides a brief description of the Chaparral guided missile system. A detailed description is provided in TM 9-1425-1585-10-1.

LAUNCHING STATION

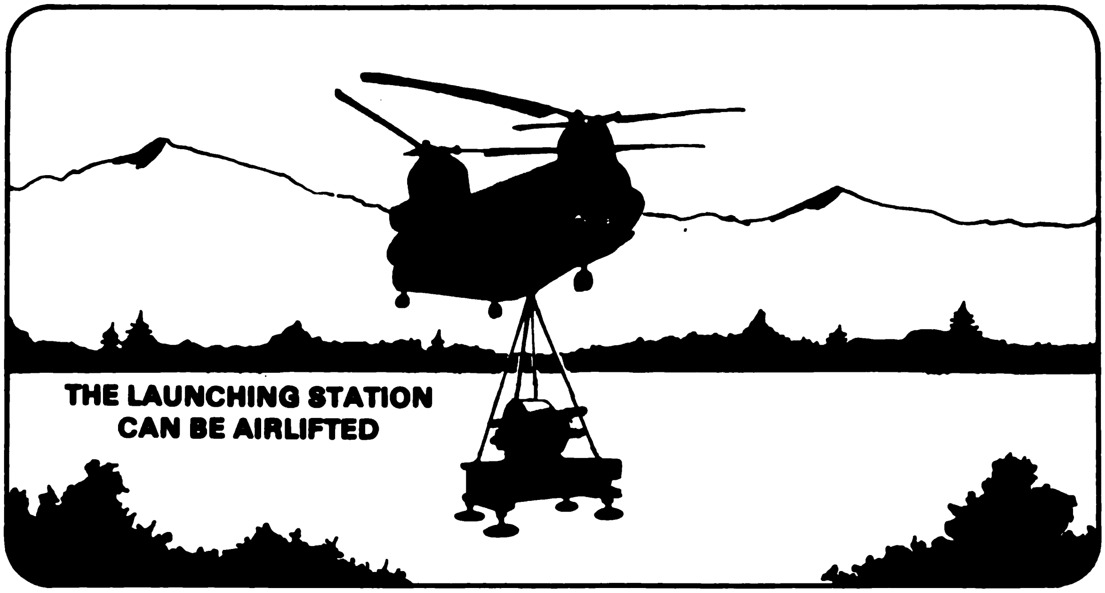


M54A1 LAUNCHING STATION

Guided missile system, intercept-aerial, M54A1, is the official name assigned to the Chaparral launching station. For brevity, the term launching station will be used throughout the remainder of this manual.

The launching station is an independent weapon system capable of launching missiles when it is mated to, or separated from, the carrier.

The station can be operated in a ground-emplaced mode.



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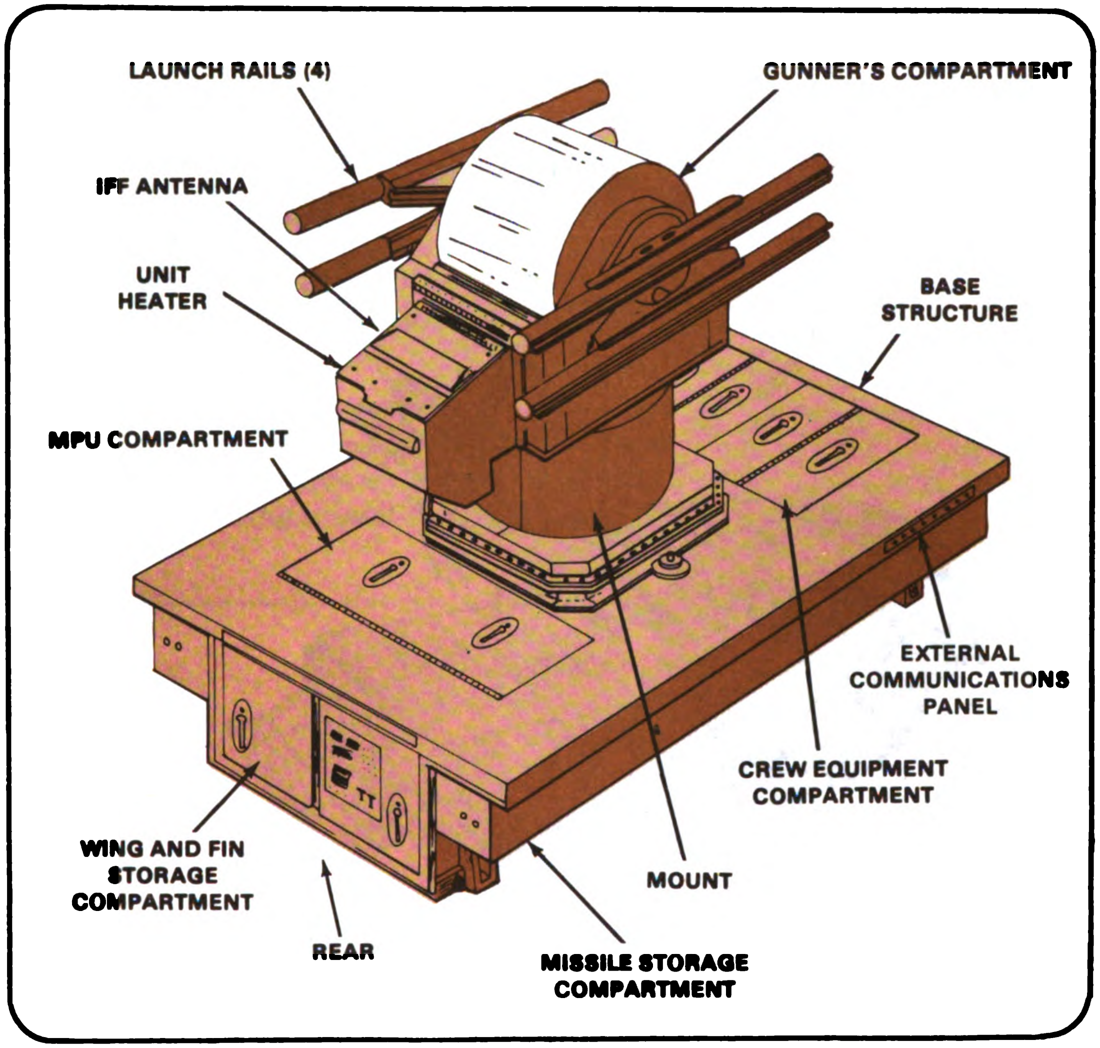
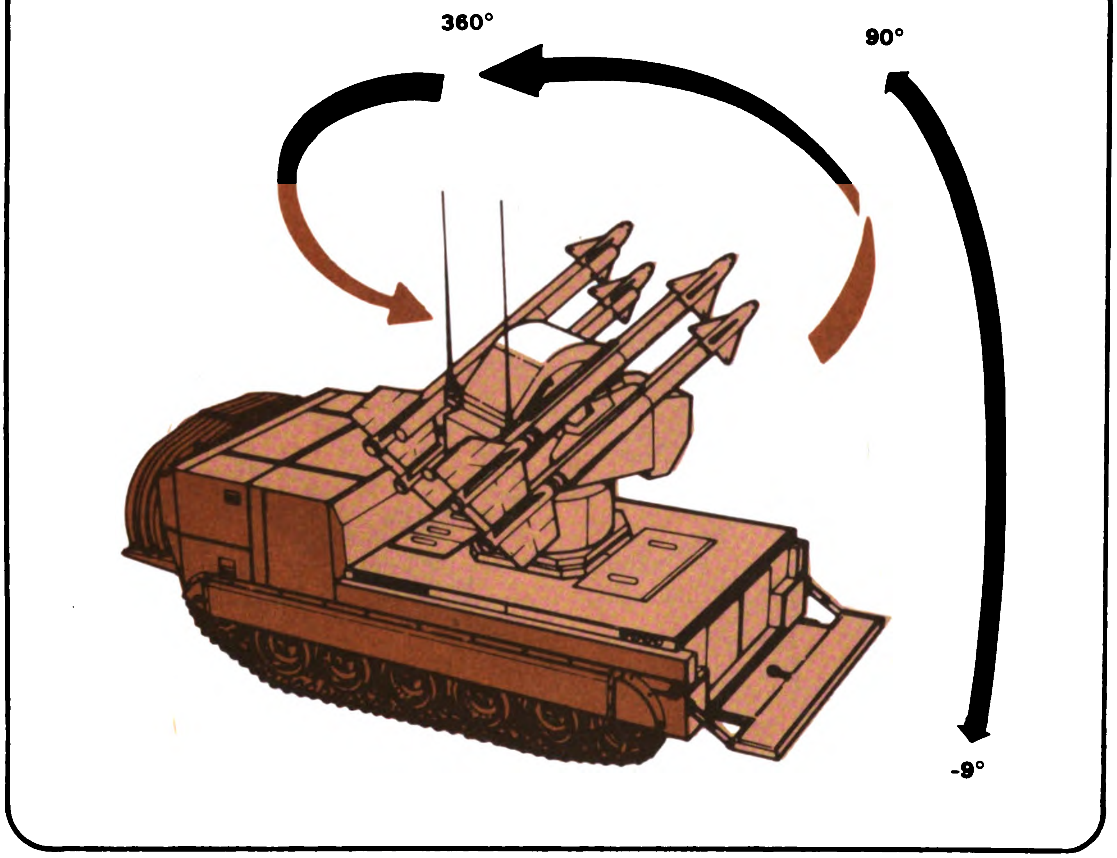

LAUNCH RAILS (4)
GUNNER'S COMPARTMENT
IFF ANTENNA
UNIT HEATER
BASE STRUCTURE
MPU COMPARTMENT
EXTERNAL COMMUNICATIONS PANEL
CREW EQUIPMENT COMPARTMENT
WING AND FIN STORAGE COMPARTMENT
MOUNT
REAR
MISSILE STORAGE COMPARTMENT

The launching station carries a tactical load of 12 missiles: 4 on launch rails and 8 in storage compartments located along the sides of the launching station.

It consists of two major units, a base structure and a mount. Located on the base structure and mount are components that furnish:

- Power
- Mount erection-retraction
- Mount drive
- Missile control and launch
- Missile air
- Environmental control
- Communications
- Identification, friend or foe (IFF)

MOUNT



The mount is the movable part of the launching station. It provides the gunner with the means for aiming and launching missiles. It has an inclosed, environmentally controlled compartment for the gunner and carries four ready missiles on its launch rails.

The mount can be rotated 360° in azimuth and its launch rails can be elevated in the vertical plane from -9° to 90°. For road travel the mount is retracted into the base, and must be erected before firing missiles.

THE BASE STRUCTURE:

- Houses various items of the functional subsystems.
- Supports the mount.
- Provides storage space for missiles.

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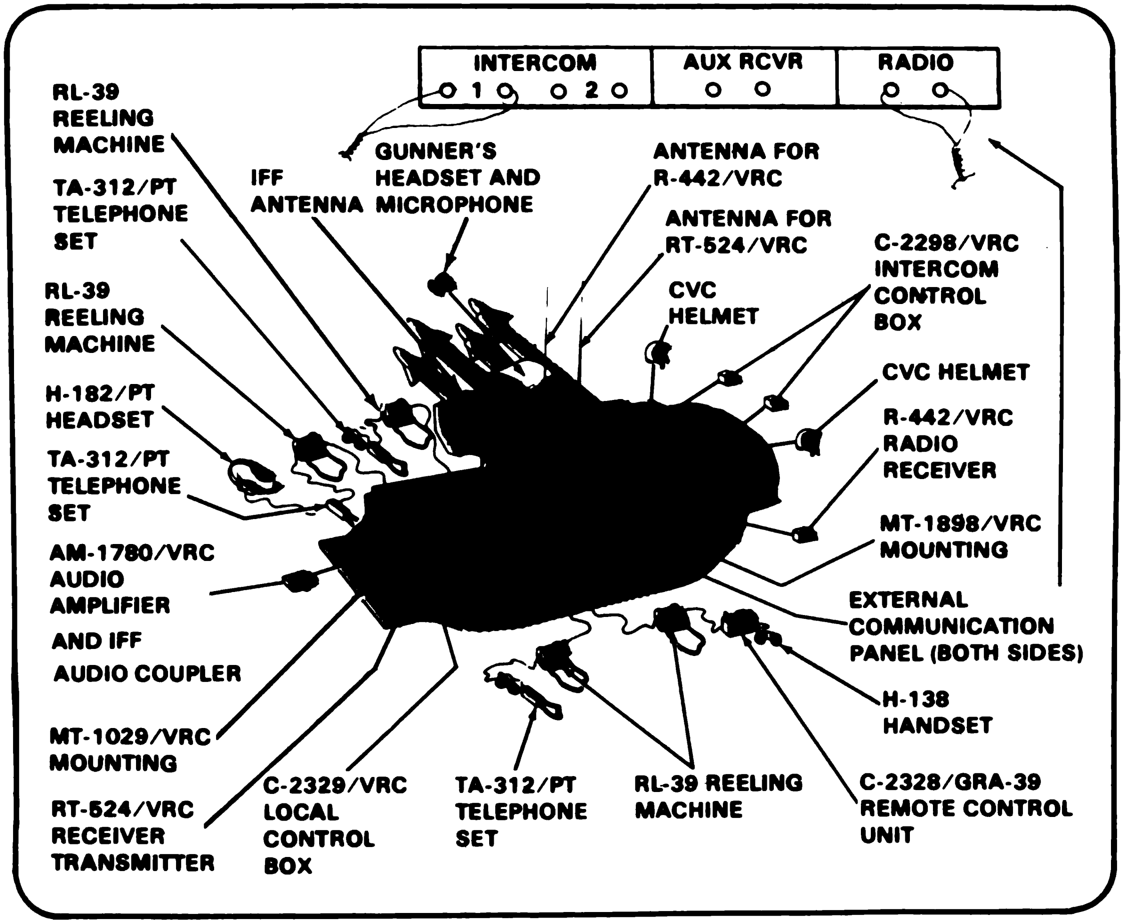
- Provides for the interface between the launching station and either the Chaparral carrier or ground emplacement jacks.

The top deck of the base structure is coated with material to provide protection against heat and blast when launching missiles. Access to the components' mounted within the base structure is provided by doors in the top deck and one door at the rear of the structure.

One missile storage compartment, with bins for four storage cases, is mounted on each side of the structure. A storage compartment for missile wings and fins is in the rear of the structure.

The environmental control subsystem maintains a comfortable temperature in the gunner's compartment, provides fresh filtered air for the gunner, and maintains a slight positive air pressure within the compartment to exclude toxic gases generated during missile firings (hydrogen chloride).



The communications subsystem provides for radio communications between the squad and platoon headquarters, and for voice communications between squad members. Communications can be operated from a remote location.

TABULATED DATA, LAUNCHING STATION, M54A1

Base Structure

Weight (w/o missiles)	10,000 pounds (4536 kg) (approx)
Length	10.7 feet (3.261 meters)
Width	7.8 feet (2.377 meters)
Storage	8 missiles, crew equipment, missile wings and control fins.
Subassemblies	Main power unit, system batteries, air compressor, communications.
Armor	None.

Mount

Weight	4,138 pounds (1877 kg).
No. of launch rails	4
Traverse	
(a) Limits	None (360°)
(b) Rate	90° per second
Elevation	
(a) Limits	-9° to 90°
(b) Rates	60° per second
Sight	
(a) Type	Reflex
(b) Model	M75
(c) Magnification	Unity
Communications	Radio set AN/VRC-47, radio set control group, AN/GRC-39, intercom field telephones
IFF Interrogator	
(a) Model	AN/PPX-3A
(b) Power supply	15 Vdc internal battery
(c) Interrogations	200 interrogations per day for 4 days before battery recharge.

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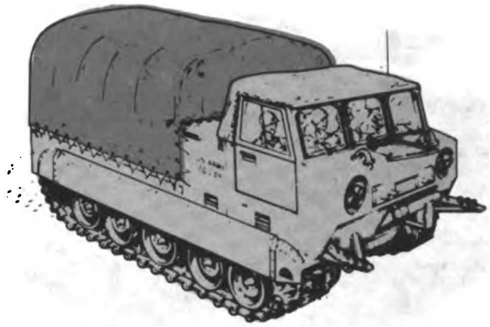
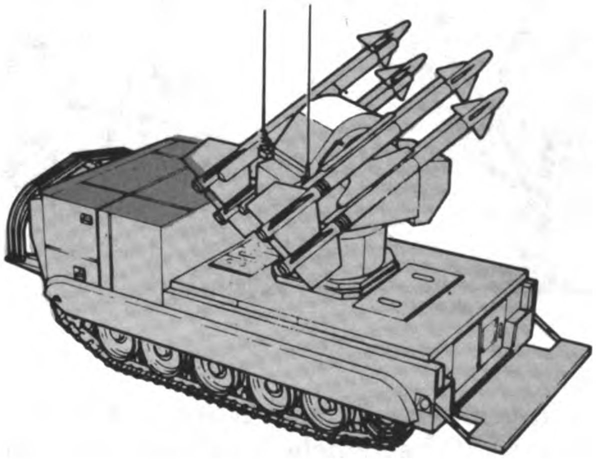
CARGO COVER



A cargo cover may be installed to protect the launching station from the elements outside the combat zone. The outboard wings on the upper right and upper left missiles, and the radio antenna must be removed to allow the cargo cover to be put on.

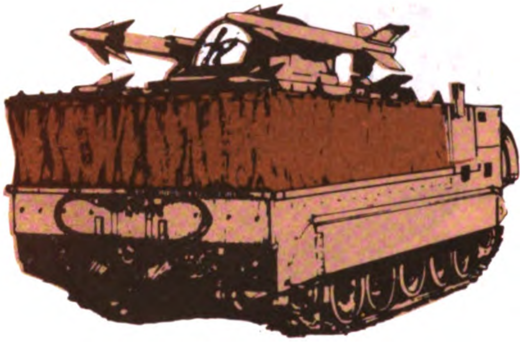
The cargo cover, when installed, can deceive the enemy as to the cargo and purpose of the vehicle. All of these covers must be removed before firing missiles.

BLAST COVERS



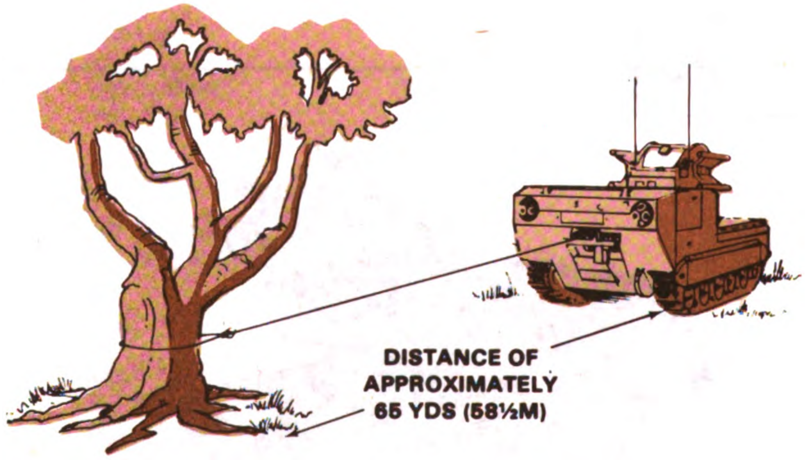
Blast covers, covered with an erosion and heat resistant material, are folded over the cab and engine compartments to protect them from the heat and blast of the rocket-motor exhaust generated at missile launch.

MOBILITY



The M730 has a forward speed of 38 mph (61 kmph) and a cruising range of 300 mi (482.8 km).

The M730 can ford streams up to 40 inches (101.6 cm) deep at speeds up to about 3 mph (4.8 kmph). The depth limitation includes the height of waves and splashes. A swim kit can be installed that will enable the Chaparral to cross water deeper than 40 inches, provided wave height does not exceed 12 inches (30.5 cm).



A winch holding 200 feet (61 meters) of 5/8-inch (1.34 cm) wire rope is mounted on the front of the vehicle. Maximum line pull of the winch is 20,000 pounds (9,072 kg) and it has a maximum line recovery speed of 15 feet per minute under full load.

Tabulated data for Carrier, Guided Missile Equipment, Self-propelled, M730, is listed in TM 9-1425-1586-10.

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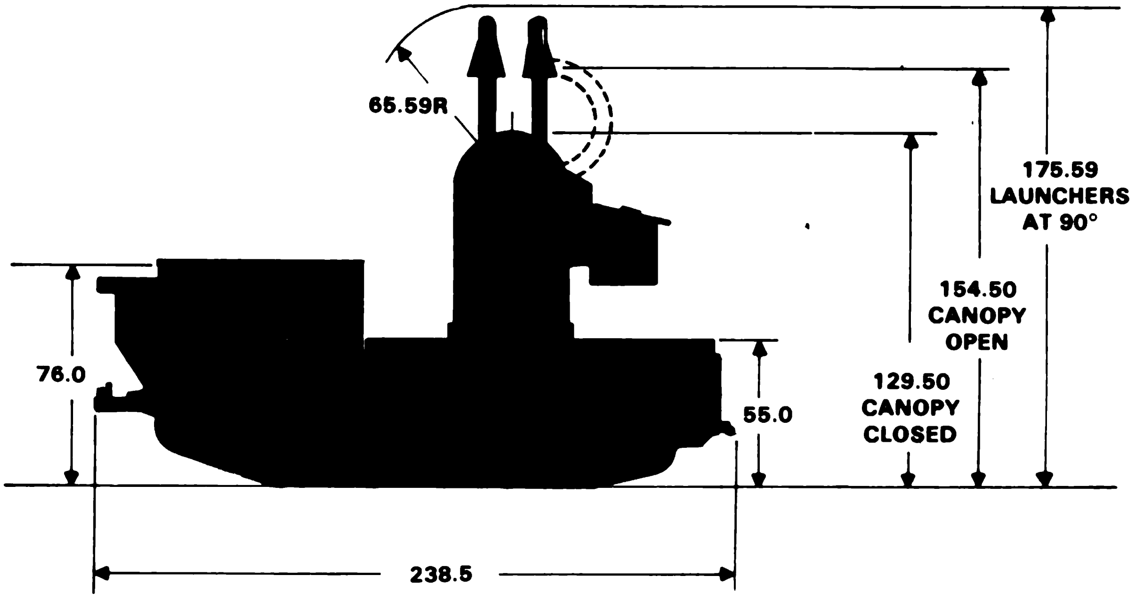
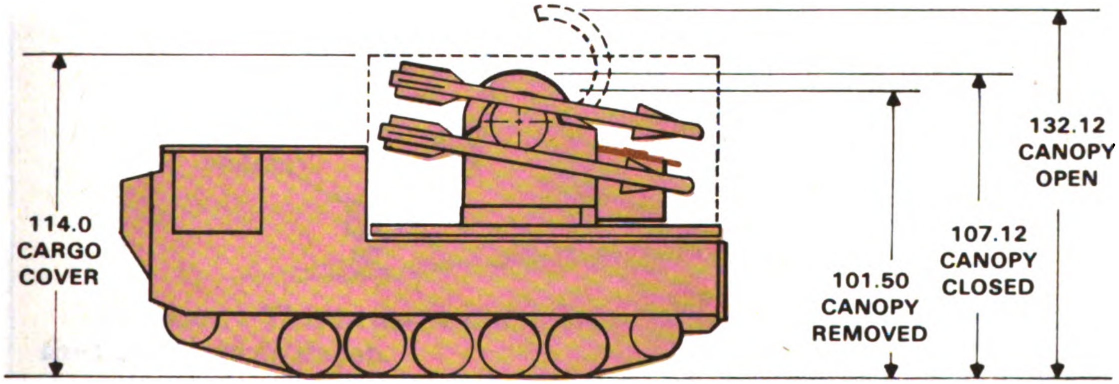
DIMENSIONS



MOUNT ERECTED



MOUNT RETRACTED

VEHICLE: LENGTH 238.5, WIDTH 105.75, HEIGHT (CARGO COVER) 114.0

MISSILE LENGTH: 114.5

ERECTION TRAVEL: 22.38

Note. DIMENSIONS ARE IN INCHES.

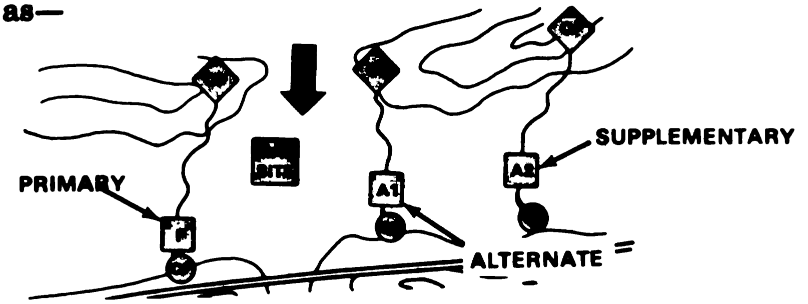
COMMUNICATIONS

When radio contact with the platoon leader cannot be made, the site should normally not be used. When the target alert data display set (TADDS) cannot receive from the forward area alerting radar (FAAR), the site should normally not be used. Hills and large buildings may block the line-of-sight communications needed for the radios.

Within the squad, telephones will be used. If wire cannot be laid, hand signals may suffice.

POSITION TYPES

Positions selected for Chaparral squads defending a fixed asset are classified as—



Primary. This is the best site available in the designated area for the fire unit to do its job.

Alternate. This is a position generally close to the primary position. An alternate position allows the squad to perform its original mission should the primary position become untenable or unsuitable. Tentative alternate positions are selected during the map reconnaissance of the primary position. Once the squad becomes operational at the primary position, RSOPs are conducted for alternate positions.

Supplementary. This is a position which provides the best means to accomplish a task that cannot be accomplished from primary or alternate positions.

Platoon headquarters. The platoon leader selects the platoon headquarters site. The site chosen is—

- Centrally located with short lines of communications to the fire units when wire communications are used and the terrain permits, or
- Collocated with one of the fire units for radio backup and increased local security.

After approving the fire unit sites, the platoon leader informs the battery commander or the S3, as appropriate, of the location of the fire units and the platoon headquarters.

OCCUPATION

Plans. The platoon leader must plan for occupation of sites as they are selected. This plan must be in agreement with the plan of the battery. The plan must cover—

- The time that the platoon must be in operation at the new site.
- Primary and alternate routes and travel times from the old site to the new site.
- Communications during the move.
- Security during the move and occupation.

Orders. Once the plan is formed, orders are issued to carry it out. The move should be made as quickly as possible to reduce the time that the fire unit is out of action. Each fire unit should report ready for action within 15 minutes after arriving at the new site. When all units have reported ready, the platoon leader will report the platoon as ready for action.

Sandbag and earth revetments can be built around the weapon up to the height of the launching station deck. The tracks made by men and vehicles must be erased.

Prepare alternate and supplementary positions as time allows. **An alternate position must be selected so that the fire unit can move to it quickly whenever its primary position is compromised.**

Establish communications. **Communications security procedures are enforced at all times. Networks include:**

Radio.

The platoon headquarters receives early warning alerting information over the one-way battalion early warning broadcast net and relays pertinent information to the squads over the platoon net.

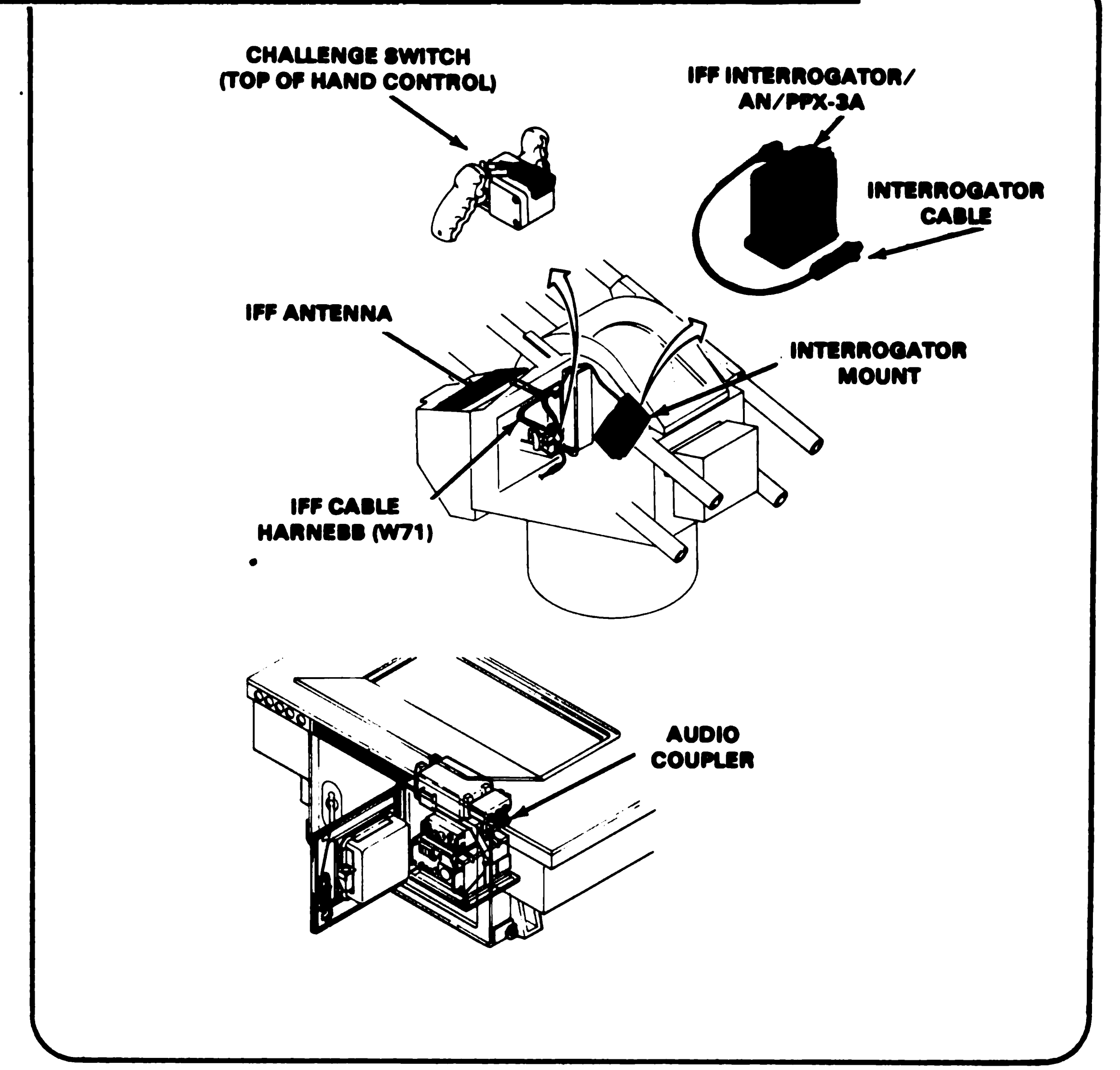
Squads receive early warning information from the FAAR via the radio frequency data link (RFDL) that is displayed on the TADDS. FAAR information may also be relayed to the TADDS by voice radio.

The platoon headquarters has radio communications with its battery, its squads, and the defended unit or asset. The squads have radio communications with each other and the platoon headquarters, and are able to monitor the defended unit or asset radio net.

Telephone.

Telephone communications may be set up within the platoon whenever it is felt that the sites will be used long enough and the tactical situation permits. The platoon headquarters has a radio operator to handle communications.

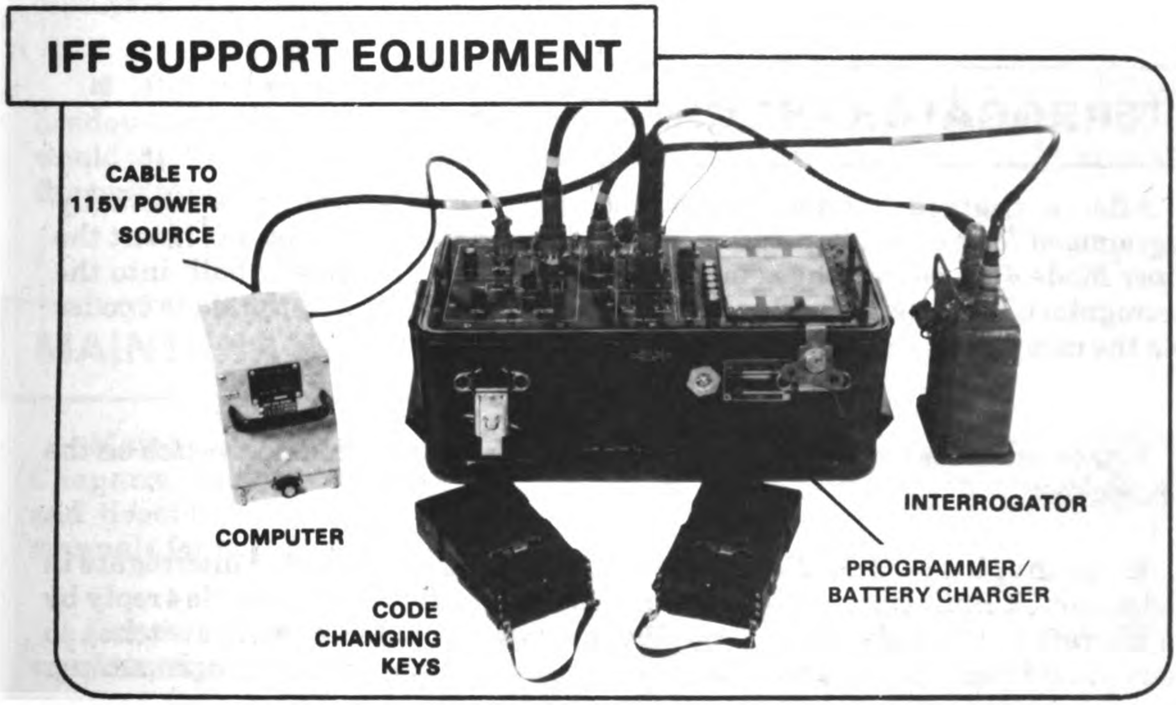
IDENTIFICATION: FRIEND OR FOE (IFF)



Chaparral is equipped with an IFF system to aid in the identification of aircraft. The IFF system classifies aircraft as either friendly or unknown. It does not identify hostile aircraft (see Hostile Criteria, chapter 3).

The gunner initiates the IFF sequence by pressing an IFF challenge button located on his hand control. Once the gunner issues a challenge, the rest of the IFF sequence is automatic. The IFF interrogator, mounted inside on the right side of the gunner's compartment, sends a coded challenge via an IFF antenna to the aircraft. Aircraft equipped with a Mark X or Mark XII transponder automatically decode the challenge. The aircraft's transponder then prepares and sends a coded reply. The reply is received by the Chaparral IFF antenna and is routed to the interrogator for decoding. The interrogator converts the reply into an audible tone which is then routed via the cable harness and audio coupler through the audio amplifier and fed into the intercom system as a friendly tone. If the aircraft's transponder sends an incorrect reply to the IFF challenge, the reply is processed by the IFF system into an unknown tone. Additionally, aircraft not equipped with the transponders will not reply to the challenge, and this is also interpreted into an unknown tone. The gunner hears the friendly or unknown tone in his left earphone immediately after challenging the aircraft. The squad leader also hears the same tone over the intercom system. The tones are further described in Engagement Procedures, chapter 3.

The IFF challenge is coded in either a complex, cryptosecure Mode 4 form or a simpler Mode 3 form. All US combat aircraft and helicopters are equipped with transponders to provide friendly Mode 4 replies. Since the Mode 4 code is secure, a friendly Mode 4 reply is considered a true friend reply. However, some aircraft operating in the combat zone, to include US commercial aircraft and some aircraft belonging to our Allies, are not capable of providing friendly Mode 4 replies. They can provide friendly Mode 3 replies, but there is a danger in relying on the less secure Mode 3 replies because they can be duplicated by enemy forces. Therefore, a friendly Mode 3 reply is considered only as a possible friend.


IFF SUPPORT EQUIPMENT

Support equipment for the IFF system is available at platoon headquarters. This equipment includes a programmer/battery charger, AN/GSX-1; computer, KIR-1A/TSEC (with power supply model ZAC A/1); and two code changing keys, KIK-18/TSEC. The computer and code changing keys are classified CONFIDENTIAL, and must be safeguarded as outlined in AR 380-40 and TB

380-41. The interrogator is also classified CONFIDENTIAL and proper security measures for it must be taken. An IFF subsystem training set is available for training purposes and is described in chapter 7.

The programmer/battery charger programs the IFF interrogator and charges the interrogator batteries. Each may be done separately or both may be done at the same time. Throughout this manual, the programmer/battery charger will be referred to as either the programmer or battery charger, depending on which operation is being described. A brief description of each follows, but TM 9-4935-1587-14 should be consulted for more detailed operating instructions.

BATTERY CHARGING

The battery charger can charge up to six interrogator batteries at one time. It takes a minimum of 4 hours to fully charge the batteries. Additional charge time will not hurt the batteries. A freshly charged battery is installed on the interrogator prior to programming.

INTERROGATOR PROGRAMMING

After a charged battery is installed, the IFF interrogator is manually programmed for 4 days of operation. The code changing key is used to insert the proper Mode 4 codes into the computer (Mode 3 codes are already built into the interrogator). The programmer provides the means for extracting the Mode 4 codes from the computer and inserting them into the interrogator.

Either one of the two programs is selected by operating a function switch on the programmer:

- In the Mode 4/3 position, the interrogator is programmed to interrogate in Modes 4 and 3. Initial interrogation is made in Mode 4. If there is no Mode 4 reply by the aircraft or the reply is incorrect, the interrogator automatically switches to Mode 3 and interrogates again. This is the normal setting used for programming.

- In the Mode 4 position, the interrogator is programmed to interrogate in Mode 4 only. The interrogator will not automatically interrogate in Mode 3 after an incorrect Mode 4 reply. Certain situations may require that the interrogator be programmed for Mode 4 only operation. Tactical SOPs dictate when the interrogators will be programmed in this manner.

For either program, a 4-day countdown period is started in the interrogator by the programmer. At the end of the 4-day period, an automatic time clock stops. The interrogator switches to Mode 3 operation and continues operating in Mode 3 until the batteries are discharged or until the interrogator is reprogrammed.

Another function of the programmer is to self-check the interrogator after data transfer. An audio signal confirms that the interrogator is operational and has accepted the program selected by the programmer. An additional test should be made by coordinating with a known friendly aircraft having an operational Mode 4 transponder. The friendly aircraft is interrogated to verify that the interrogator's Mode 4 codes are correct.

Programming is done every 2 or 3 days, depending upon the tactical situation. The interrogator may be programmed:

- By having each Chaparral squad turn in its interrogator to platoon headquarters every 3 days or less. It can be exchanged for another, if available, or it can be reprogrammed and then returned to the fire unit.
- By having the platoon headquarters visit each fire unit every 3 days to reprogram the interrogator.
- By using spare interrogators. These can be reprogrammed at platoon headquarters, taken to the fire unit, and exchanged there. The fire unit interrogator would then be taken to platoon headquarters, reprogrammed, and held for another fire unit exchange. The exchange can be done by liaison visits.

MAINTENANCE FOR IFF EQUIPMENT

Maintenance for the Chaparral IFF System is basically the same as for other Chaparral equipment. Operator/organizational, direct support, general support, and depot-level tasks are defined and described in the appropriate technical manuals for the Chaparral system.

Generally, operator/organizational-level maintenance of the IFF system consists of:

- Visually inspecting IFF equipment for external damage.
- Cleaning external surfaces/mating parts.
- Spot painting as needed.
- Removing and/or replacing defective code changer keys, computer, programmer, interrogator, simulator, and cables.

- Checking the interrogator by using its self-test feature.
- Replacing programmer light bulbs and lamp covers.

Although platoon headquarters personnel normally program and recharge the interrogator and battery, organizational maintenance personnel are capable of programming/recharging. They also fault-isolate assemblies within Chaparral-peculiar IFF units. IFF units peculiar to the Chaparral are the audio coupler, challenge switch, antenna, and cable harness. Maintenance required beyond the organizational maintenance level is referred to the direct support unit.

CHAPTER 3

ENGAGING AIRCRAFT

The role of Chaparral is to protect critical assets, troops, or installations from low-altitude air attack. The chapter discusses how it is done.

COMMAND AND CONTROL

Chaparral squads are commanded and controlled by the platoon leader, assisted by the platoon sergeant. The platoon leader furnishes to the squads the DEFCON, air defense warning, air defense weapons control status, and hostile criteria in effect. These are discussed in FM 44-3. Whenever any of this information is changed and is sent to the squads by radio or telephone, a proper authentication is required.

TACTICAL COMMANDER

The squad leader, as the fire unit tactical commander, is responsible for the decision to engage. He must make the decision in accordance with rules contained in the unit SOP.

The squad leader is responsible for:

- Identification of the target as a friend, unknown, or foe.
- Selection of the specific target to be fired at.
- Designation of the type of missile to be used.
- Selection of the method of fire to be used.

[illegible]

Rules of engagement prescribed by the region air defense commander are published in the unit SOP. They control fires to protect friendly aircraft while maintaining the level of defense required. The rules usually provide that —

- The right of self-defense against air and ground attack is never denied in peace or war.
- During conditions short of war, engagements are conducted only in self-defense or as ordered by designated commanders.
- During wartime, aircraft will be fired on in accordance with the weapons control status in effect.

FM 44-3 tells how to apply rules of engagement, including weapons control statuses and hostile criteria, in making the decision on whether to fire at an aircraft or not.

WEAPONS CONTROL STATUS

The weapons control status sets the degree of control over the fires of the Chaparral.

Weapons Free - **Fire at any aircraft not positively identified as friendly. Unknowns may be fired on in this status.**

Weapons Tight - **Fire only at aircraft positively identified as foe according to the hostile criteria in the SOP. This should be the normal status in wartime.**

Weapons Hold - **Do not fire except in self-defense. This status may be set in an area in terms of time and aircraft type. For example: "Weapons Hold Rotary Wing." The hold is for the named aircraft only.**

HOSTILE CRITERIA

Target identification as hostile must be based on visual inspection of the target and its assessment against specific hostile criteria. The exact criteria in use may vary with the tactical situation, from command to command, and in terms of time. For example, the SOP may classify as hostile those aircraft that are:

Attacking friendly elements. Any aircraft actively attacking the fire unit or friendly troops, areas, or installations will be identified as hostile.

Responding improperly to electronic IFF interrogation. A FAAR/TADDS or Chaparral IFF unknown indication may be accepted as a first assumption of hostility. However, the possibility exists that the IFF system may not furnish a proper identification. This may happen if the aircraft transponder and/or the Chaparral IFF interrogator is damaged, malfunctioning, or incorrectly coded. Therefore, under a WEAPONS TIGHT control status, an IFF unknown reply is backed by visual identification. The squad leader must successfully apply at least one more hostile criterion based on visual observation of the aircraft before he can declare it to be hostile. On the other hand, if a WEAPONS FREE status is in effect, the squad leader may order the gunner to engage an aircraft based on an IFF unknown reply. In a WEAPONS HOLD control status, engage only those aircraft attacking you, regardless of the IFF reply.

Performing any of the following acts over friendly troops or territory without prior coordination.

- Discharging smoke or spray.
- Dropping flares.
- Engaging in mine-laying operations.
- Discharging parachutists or unloading troops in excess of normal aircraft crew.
- Dropping electronic countermeasures such as chaff, reflectors, sensors, etc. Due to the possibility of a communications lag, wherein "prior coordination" to squad level may not be accomplished prior to friendly aircraft doing these acts, the squad leader should apply this criterion with care. Generally, at least one additional criterion should successfully be applied before an identification as hostile is made.

Unauthorized or improper entry into an area designated as restricted or prohibited. Care should be exercised in the application of this criterion to avoid identifying as hostile a friendly aircraft that has been damaged and is returning to the rear of our lines or has inadvertently strayed into the restricted area due to a navigation error.

Operating at prohibited speeds, altitudes, or in prohibited directions. Determination of aircraft speed and altitude by ground observers is difficult. Extreme care should be exercised in applying this criterion.

Bearing the military marking or having the configuration of an aircraft employed by a known enemy nation. This is the criterion most likely to be used by the Chaparral squad leader and probably the most difficult to apply. Application of this criterion must be based on visual inspection of the aircraft and requires the squad leader to be expert in the field of visual aircraft recognition. Since aircraft markings are not usually visible at long ranges, most identifications must be based on recognition of the physical features of the aircraft. To eliminate any element of doubt the squad leader must be capable of recognizing friendly as well as enemy aircraft. Also, since all Chaparral squad members are potential squad leaders, all squad members must be expert in the field of aircraft recognition. (For a detailed discussion of aircraft recognition refer to TC 44-30.)

Recognition of the aircraft by name or country of manufacture is helpful, but it is not conclusive. For instance, the Mirage III/V is made in France. However, it is in service in 23 countries in Europe, Middle East, Africa, and South America. Other aircraft are similarly spread throughout the world, including some made in the United States of America.

FIRE COORDINATION

Fire coordination is accomplished by the platoon leader to—

- Regulate multiple engagements of the same target.
- Conserve ammunition.
- Shift primary and secondary sectors of fire.

The platoon leader accomplishes fire coordination by—

- Designing a proper defense.
- Assigning each squad one primary and one or more secondary sectors of fire. Targets in the primary sector have priority for engagement.
- Disseminating weapons control statuses, changes in hostile criteria, and early warning of aircraft approaching the squad.

AIRCRAFT DETECTION

Observer procedures. The first step in a Chaparral engagement is visual detection of the target. This may be done by any one in the squad. In every case the target location must be made known to the squad leader and gunner. The range at which aircraft may be detected varies with the conditions under which detection is tried. Some of these conditions are—

- **Terrain masking.** Since Chaparral observers are on the ground, the local terrain will influence the distance at which low-altitude aircraft will unmask, i.e., not be hidden behind a hill or other feature. Terrain masking should be kept in mind when selecting a site.

■ **Target characteristics.** The main features of an aircraft that affect detection range are—

Size. The larger the target, the farther away it can be detected. Apparent aircraft size varies with the type of aircraft and the aspect from which it is viewed. A jet fighter flying a course directly toward or away from an observer shows a small profile. If approaching, it can get quite close to the observer before it is detected. The same aircraft on a crossing course has a much larger profile and thus can be detected at a greater range.

Color. The color of an aircraft affects the degree with which the aircraft contrasts with the background against which it must be seen. The background in the direction from which targets are expected to come should be considered in choosing observer positions. Many jet aircraft leave a dark smoke trail that can be used as an aid in detection at long ranges.

Speed. Target speed affects the visual detection of aircraft. Detection range gets less as target speed increases.

Altitude and heading. Targets flying at altitudes of 150 to 1,200 feet (46.7 to 366 meters) are detected at longer ranges than those higher or lower.

Meteorological visibility. Rain, snow, dust, fog, smoke, and haze tend to reduce the range of visual detection of aircraft.

Visual acuity. Observers are required to detect, recognize, and identify small objects at long ranges. Therefore, they must have good visual acuity (keen eyesight). Binoculars have little effect in detection because they have narrow fields of view. This increases the time required to search a given area of space. Binoculars may help to identify a target.

Search sector size. Search sectors should be as small as possible and still have good coverage to both sides of the expected avenues of target approach. When observers are alerted to an approaching target, the search sector should be reduced and concentrated in the direction of the expected approach.

Observer fatigue. Long periods of observer duty may degrade performance due to fatigue. Observer duties should be rotated as often as possible.

SEARCH TECHNIQUES

Two ways are used to look for aircraft:

- One for flat terrain.
- One for hilly terrain.

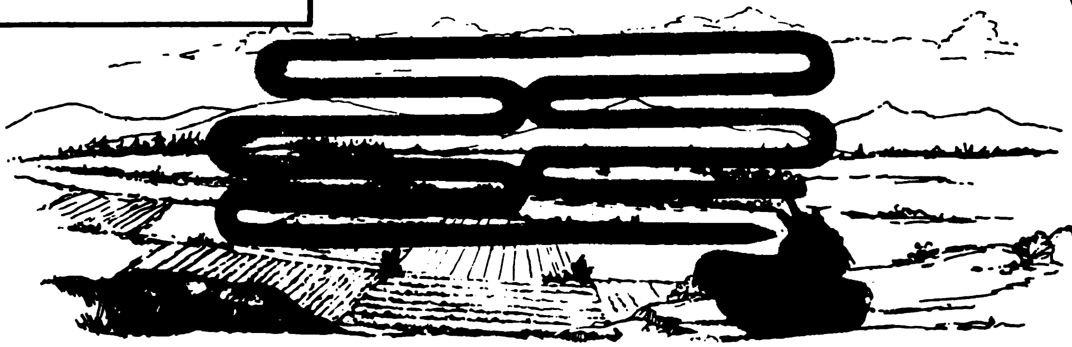
In both, the observer should:

- Frequently focus his eyes on a distant object, such as a cloud or terrain feature. Otherwise, his eyes will tend to relax and distant objects become blurred.

- When searching near the sun, block out the sun with an extended thumb. Looking directly at the sun, without shielding the eyes, can cause blindness for a few seconds.

- Keep his eyes on the aircraft once he sees it. If he has to look away from it, he notes the direction in which it is heading. He moves his eyes away from it when it is near some object, such as a cloud, that will guide his eyes back to it.

FLAT TERRAIN

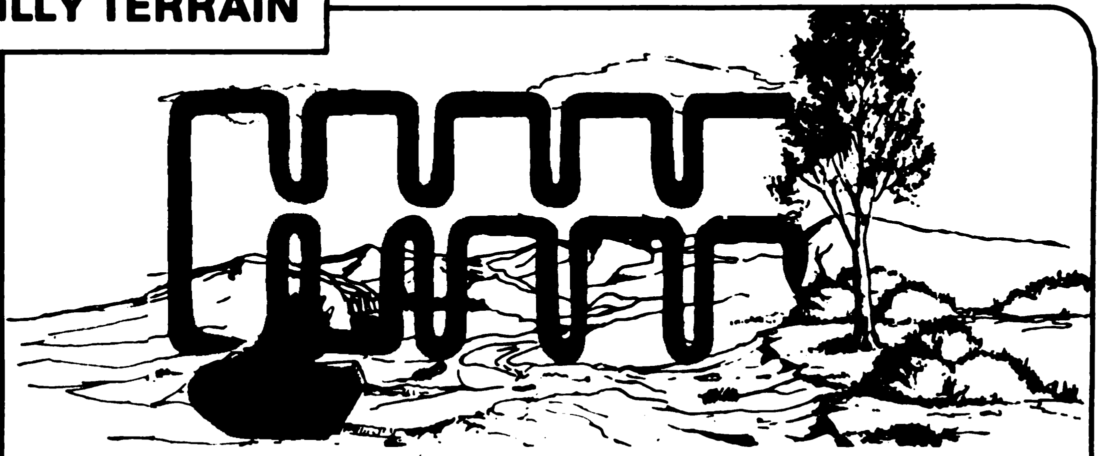


In flat terrain, the observer searches the horizon to about 20° (356m) above the horizon by moving his eyes in short movements across the sky, working his way up and across.

Continues the scan pattern below the horizon to detect aircraft flying nap-of-the-earth.

More detail is registered this way than with a continuous scan of the horizon.

HILLY TERRAIN



In hilly terrain the observer searches the sky using the horizon as a starting point and prominent terrain features as points of reference. He moves his eyes in short movements up the sky, then back down, continuing this movement across the terrain.

He scans in the same pattern below the horizon to detect aircraft flying nap-of-the-earth.

SOME THINGS TO LOOK FOR

Many aircraft have tell-tale signatures which can lead to early detection. Chaparral squads should look for such things as:

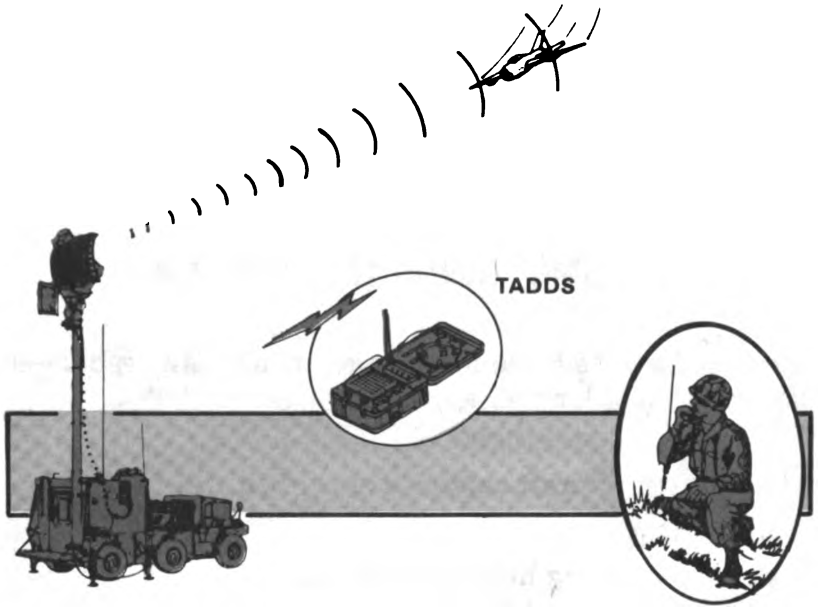
- Sun reflection from aircraft canopies or cockpit windows.
- Blade flash from rotating helicopter blades.
- Smoke or vapor trails from jet aircraft and missiles or rockets fired from aircraft.
- Dust or excessive movement of tree tops and bushes in a particular area.
- Noise from helicopter blades or from jets breaking the sound barrier.

ALERT WARNING

An *alert warning* is an early warning, or indication of air attack. Warning of the approach of an aircraft increases the chances of successfully engaging it.

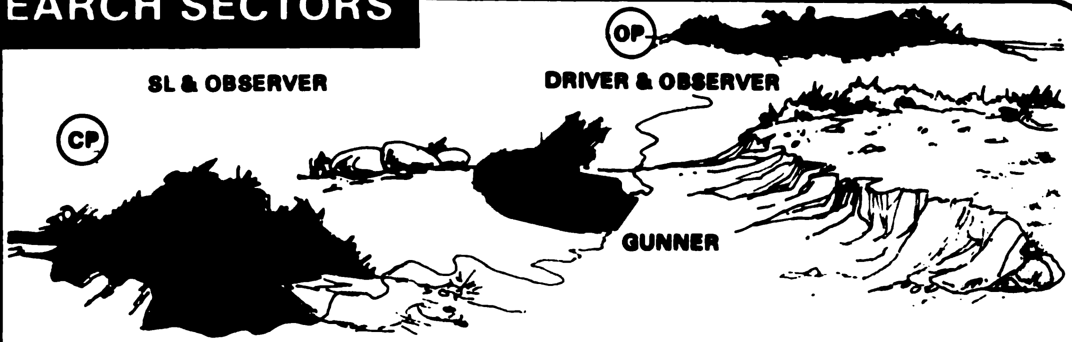
Once a squad has been *alerted,* it is *cued* to the air attack. Cueing information provides an azimuth, tentative identification, and range of the target. Cueing information may accompany an alert warning, but normally follows it.

A Chaparral squad receives alerting/cueing information of an approaching aircraft by the C/V battalion early warning broadcast net (relayed by plt HQ), the forward area alerting radar (FAAR)/target alert data display set (TADDS) system or other warning means, or it may visually detect the target without prior warning.



Operation and use of the FAAR and TADDS are contained in FM 44-6, Procedures and Drills for Forward Area Alerting Radar (FAAR) and Target Alert Data Display Set (TADDS).

SEARCH SECTORS

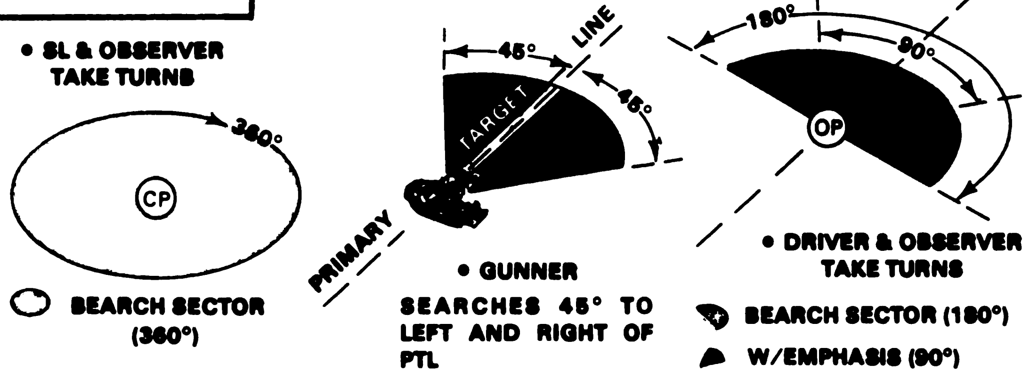


When the Chaparral squad occupies tactical positions, squad members are assigned search sectors by pairs. This allows one member to be searching for aerial targets while his partner rests his eyes and provides ground security. They take turns searching.

Search sectors are arranged to provide all-around coverage of the entire area and overlapping coverage of the assigned sector of fire and likely approach routes.

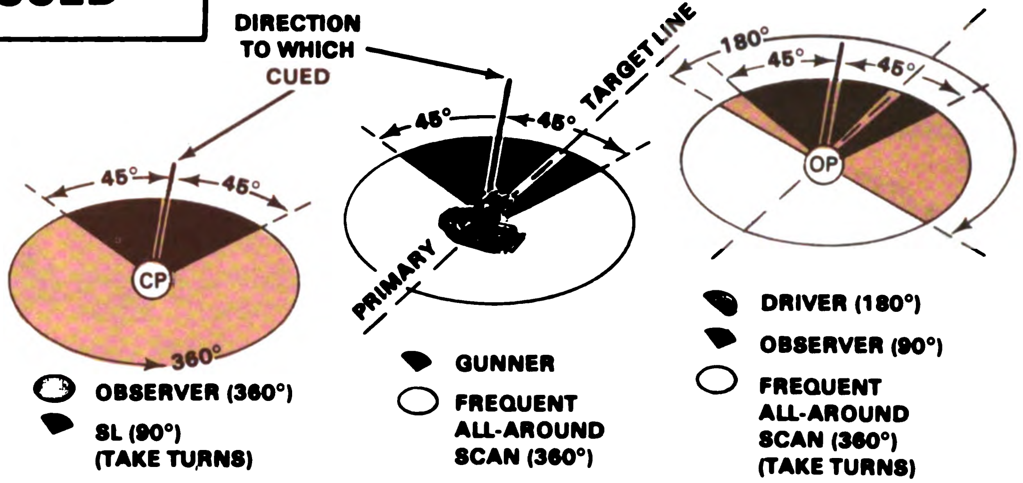
When an alert warning is received, all squad members shift search emphasis to the azimuth of anticipated approach (with frequent all-around scans) until one member detects the target.

ALERTED



When alerted to the approach of an aircraft, one crewman at the OP will search a 180° sector. He will place emphasis on a 90° sector, 45° to each side of the primary target line (PTL). One crewman at the CP will search in a complete circle. The gunner will have the Chaparral system ready for action at all times. He will also focus his attention on a 90° search sector, 45° to each side of the PTL.

CUED



When cued to the approach of an aircraft, the whole crew will act as observers. The squad leader, gunner, and one crewman at the OP will search a sector 45° to either side of the approach azimuth. The other crewman at the OP will continue to search the 180° sector and the crewman at the CP will continue to search the 360° complete circle. This will cause rapid detection of the aircraft to which cued, and yet not allow any other aircraft to sneak in undetected.

IDENTIFICATION

Firing of a Chaparral missile at an aircraft must be based on identification of the aircraft as a HOSTILE (or under certain conditions as an UNKNOWN). This identification is based on visual inspection of the aircraft and the application of specific hostile criteria. The responsibility for aircraft identification rests with the squad leader. In every case the identification must be completed before the squad leader can give a command to engage.

METHOD OF ENGAGEMENT

The method used to engage aircraft depends upon how many there are. A multiple target raid is a raid by two or more aircraft flying the same course, at the same speed, less than 1,000 meters apart. All other raids are single target raids.

All single target raids are engaged using a SHOOT-LOOK-SHOOT technique of fire. This method is the firing of a missile (SHOOT) as soon as the requirements for an engagement are met. Then an evaluation (LOOK) of the performance of the missile to see if it hits. A second (SHOOT) missile is fired if the first does not destroy the target.

If a missile leaves the launch rail and appears to be on a guided course toward the target, the missile is assessed as successful and another is not fired until a kill evaluation can be made.

If the missile fails to leave the launch rail, or appears to have failed to achieve guided flight, it is assessed as unsuccessful and a commmand to fire another missile is given.

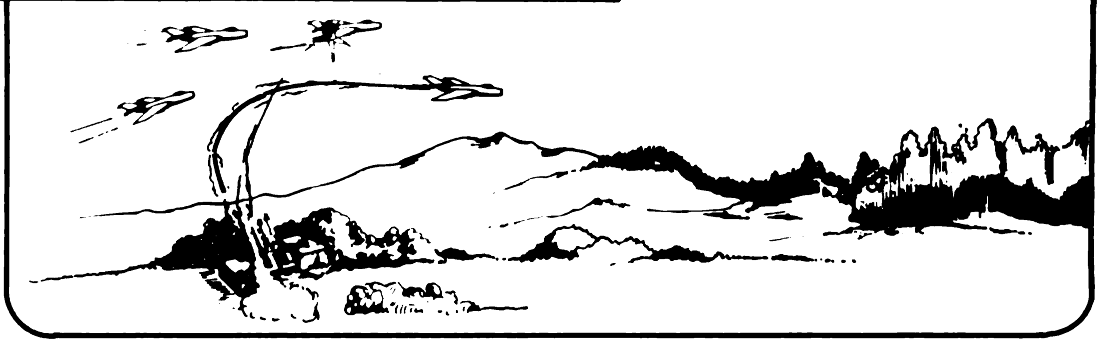
If an otherwise successful missile fails to kill the target, a command to fire another missile is given.

When using the SHOOT-LOOK-SHOOT method of fire, each missile fired must be preceded by a fire command and meet the gunner's requirements for launching.

Upon firing the first missile, the gunner regains visual tracking and IR tone as quickly as possible for the firing of the second missile.

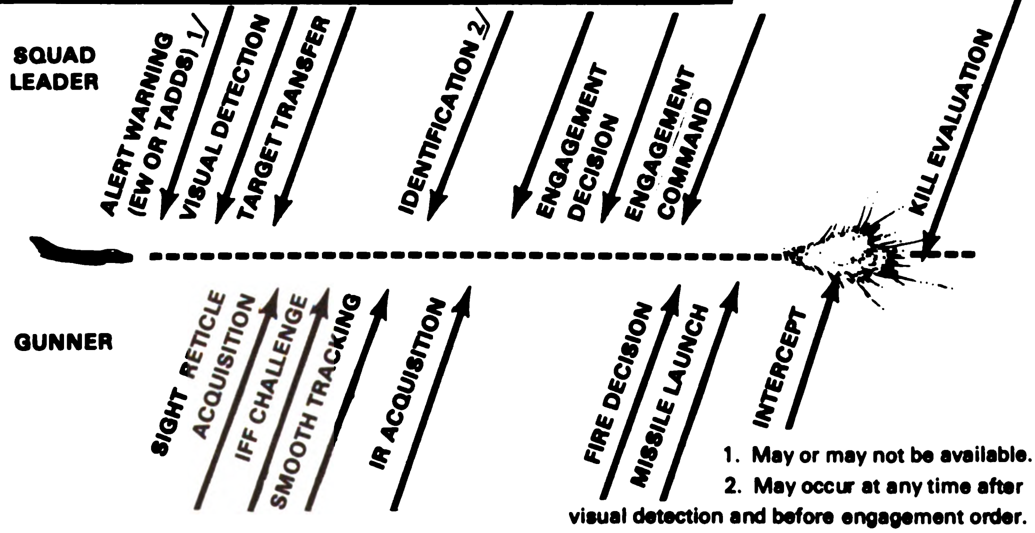
The gunner does not watch the flight of the missile. The squad leader observes the flight of the missile, makes the kill evaluation, and commands the launch of more missiles, if needed.

MULTIPLE AIRCRAFT RAIDS



Multiple aircraft raids are engaged using a SHOOT-NEW TARGET-SHOOT technique of fire. This requires the launching of as many missiles as possible at successive aircraft in the raid. The squad leader gives the order in which aircraft are to be engaged; e.g., FRONT-TO-REAR or LEFT-TO-RIGHT. The gunner will engage aircraft in that order, firing one missile at each aircraft as fast as possible. A command is not required for each missile after the first and no kill evaluation is made between launches. Each launch must still meet the requirements for engagement.

CONDUCTING THE ENGAGEMENT



1. May or may not be available.
2. May occur at any time after visual detection and before engagement order.

The engagement of an aircraft by a Chaparral squad using either type of missile consists of a sequence of events that begins with the detection of an aircraft and ends with its destruction. The major events in the 10- to 20-second sequence are shown above.

ENGAGEMENT PROCEDURES

The exact procedures will vary slightly from situation to situation but will, in general, be as follows:

Alert warning. An alert warning of approaching aircraft may be received over the—

- C/V battalion early warning broadcast net.
- FAAR/TADDS system.
- Command net.
- Radio from the supported unit or other nearby unit.
- Intrasquad communications system from a squad member who detects the aircraft.

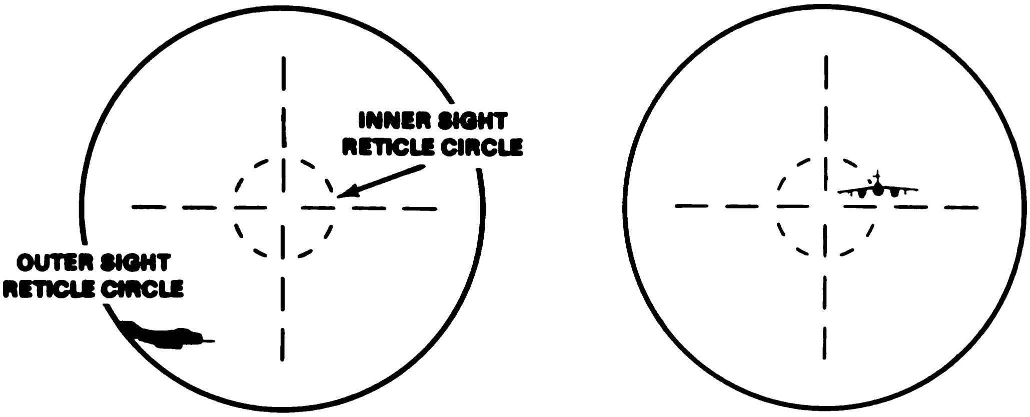
When an alert warning is received by the squad leader, he repeats it over the intercom. Squad members then modify their search emphasis (see Search Sectors, Alerted and Cued).

Visual detection. The squad member first detecting a target announces, TARGET, over the intercom, followed by a location statement. This includes clock azimuth, altitude in terms of high or low, and if a multiple target, the words, MULTIPLE TARGET.

Target transfer. Upon hearing the detection report the squad leader starts visual search at the azimuth announced for the target. The squad leader talks with the observer as necessary until he has located the target and then announces, CONTACT. The observer then returns to searching his assigned sector for other aircraft.

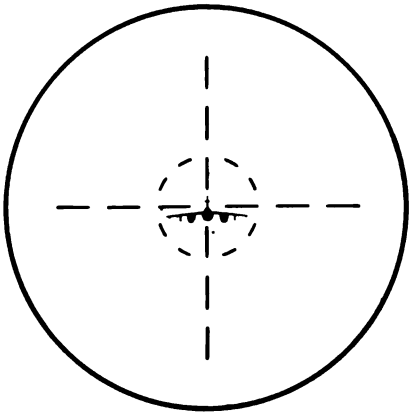
Sight reticle acquisition. The squad leader directs the gunner to the target's azimuth. The gunner slews the mount to the azimuth of approach. The squad leader repeats the target location until the gunner locates the target and acquires it in his sight reticle. If multiple targets, the squad leader specifies which target will be engaged first. Once the gunner acquires the target in his sight reticle, he says, CONTACT, and issues an IFF challenge.

IFF Challenge. The gunner issues an IFF challenge to the target by pressing the IFF challenge switch. The target must be within the outer circle of the sight reticle when challenged. It is not abeolutely necessary that the target be within the inner sight reticle circle at this point.



A multiple challenge, time permitting, will increase the probability that the reply is coming from the aircraft being challenged.

Smooth tracking. The gunner begins to track the target smoothly. Smooth tracking is defined as being able to hold the target within the inner sight reticle circle more than half the time.



Identification. The gunner receives the IFF reply from the target as a tone in his left earphone (if the IFF system is defective, no tone will be heard). IFF tones will be louder than any other communications heard over his left earphone. Since the gunner is receiving other audio tones over his headset, the squad leader must help the gunner by monitoring specific IFF replies over the intercom and identifying them. The three distinct tones, or no tone, indicate:

- MODE 4 TRUE FRIEND--a beep, pause, and then another beep. (BEEP__________ BEEP)

- MODE 3 POSSIBLE FRIEND--a long, steady beep. (BEEEEEEEEEEEEEEEP).

- **UNKNOWN--a series of short beeps. (BEEP, BEEP, BEEP, BEEP).**
- **SELF-TEST FAIL--no tone.**

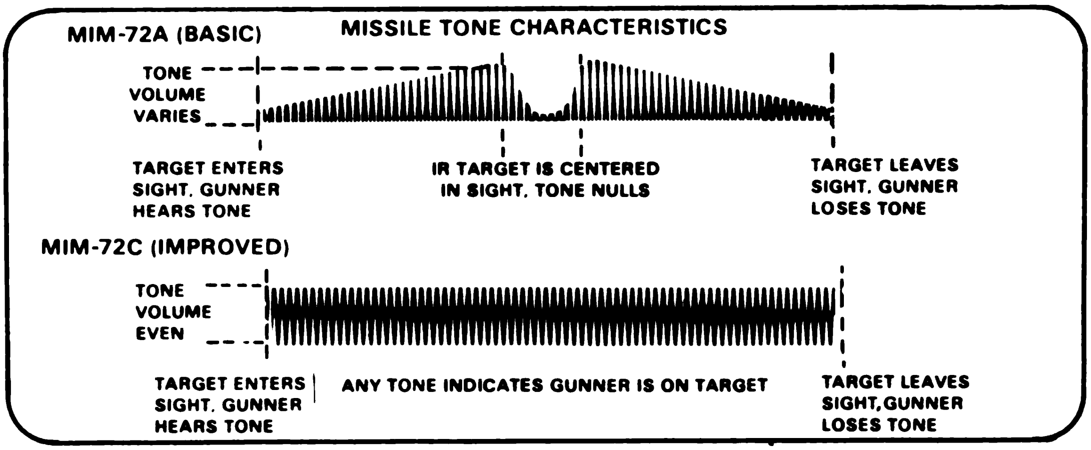
The squad leader must make a final identification of the target.

NOTE. ***The target identification decision may be chenged at any point in the engagement.***

He considers the IFF reply in arriving at his decision, but must also consider the weapons control status in effect.

IFF TONE	WEAPONS CONTROL STATUS		
	WEAPONS HOLD	WEAPONS TIGHT	WEAPONS FREE
MODE 4 TRUE FRIEND	REGARDLESS OF IFF TONE, TARGET IS DECLARED HOSTILE, AND ENGAGED, IN SELF-DEFENSE ONLY.	TARGET IS FRIENDLY. FOCUS ATTENTION ON NEXT IMMEDIATE THREAT. IF NONE IS AVAILABLE, RESUME TRACK ON TARGET AND VISUALLY IDENTIFY TO CONFIRM FRIENDLY STATUS.	
MODE 3 POSSIBLE FRIEND		TARGET IS POSSIBLE FRIEND. IF TARGET IS MOST IMMEDIATE THREAT, IT MUST BE TRACKED AND VISUALLY IDENTIFIED. IF TARGET IS NOT THE IMMEDIATE THREAT, STOP TRACKING AND FOCUS ATTENTION ON NEXT IMMEDIATE THREAT.	
UNKNOWN		TARGET IS UNKNOWN. TRACK AND VISUALLY IDENTIFY.	TARGET IS UNKNOWN. ENGAGE.
SELF-TEST FAIL		VISUALLY IDENTIFY TARGET. ENGAGE ONLY THOSE AIRCRAFT POSITIVELY IDENTIFIED AS HOSTILE.	VISUALLY. IDENTIFY TARGET. ENGAGE ONLY THOSE AIRCRAFT NOT POSITIVELY IDENTIFIED AS FRIENDLY.

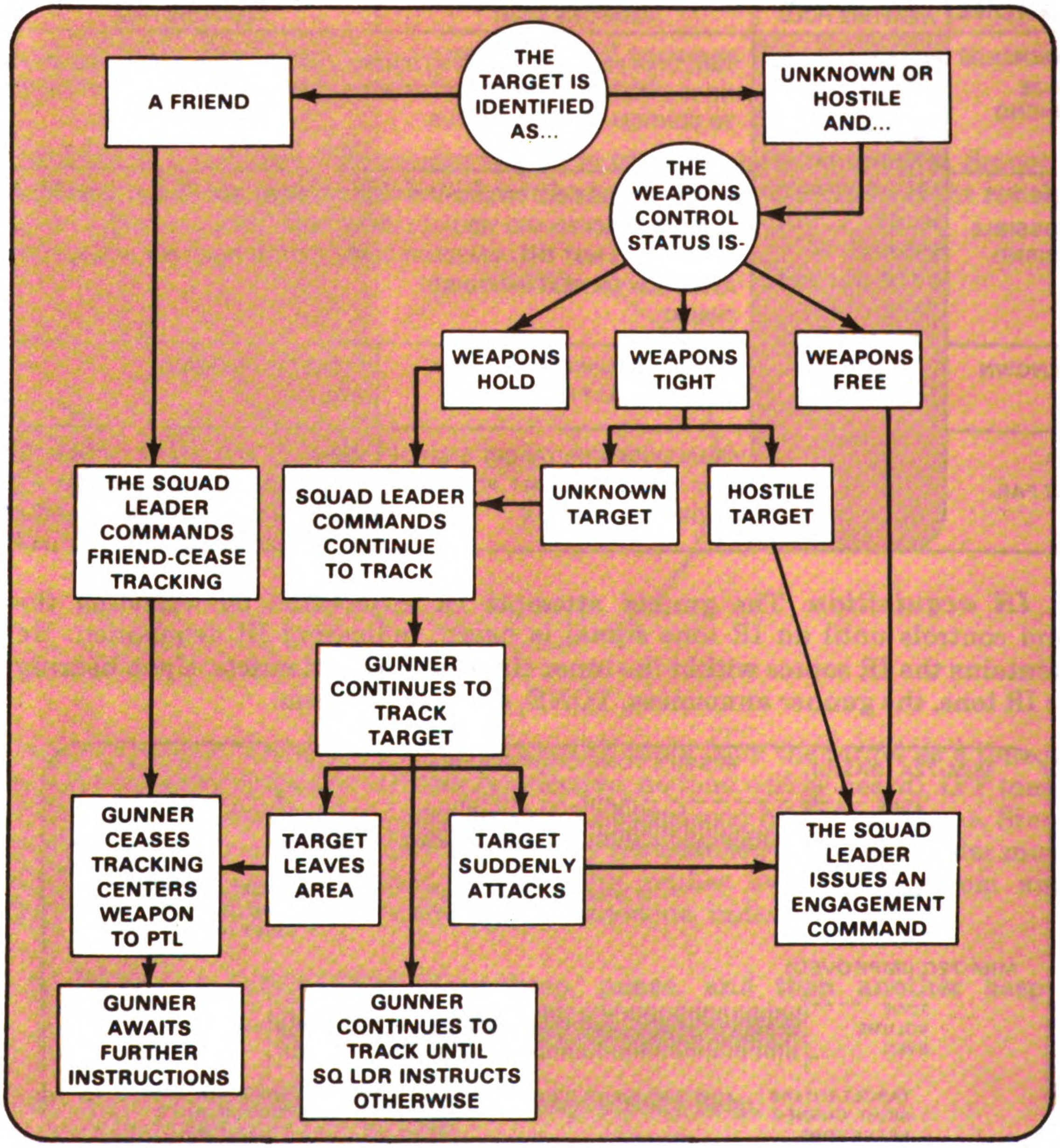
IR acquisition. **The gunner attempts IR acquisition by adjusting the** hand controls until an IR tone signal is heard, indicating IR acquisition. He **maintains the IR source within the inner circle of the sight reticle. Upon hearing the IR tone, the gunner announces, TONE, over the intercom.**


MIM-72A (BASIC)
MISSILE TONE CHARACTERISTICS
TONE VOLUME VARIES
TARGET ENTERS SIGHT, GUNNER HEARS TONE
IR TARGET IS CENTERED IN SIGHT, TONE NULLS
TARGET LEAVES SIGHT, GUNNER LOSES TONE
MIM-72C (IMPROVED)
TONE VOLUME EVEN
TARGET ENTERS SIGHT, GUNNER HEARS TONE
ANY TONE INDICATES GUNNER IS ON TARGET
TARGET LEAVES SIGHT, GUNNER LOSES TONE

When the improved missile seeker is tracking the target, a steady continuous tone will be heard in the gunner's earphone.

When the basic missile seeker is tracking the target, a tone of varying amplitude will be heard. The tone increases in amplitude as the point of tracking nears the center of the sight reticle but nulls to near nothing when the seeker is centered on the target's IR source.

If a missile tone is received, the target is considered within the launch envelope. With the improved missile, any tone is a good tone. With the basic missile, the gunner tracks the point that gives the greatest tone amplitude and then nulls.


THE TARGET IS IDENTIFIED AS...
A FRIEND
UNKNOWN OR HOSTILE AND...
THE WEAPONS CONTROL STATUS IS-
WEAPONS HOLD
WEAPONS TIGHT
WEAPONS FREE
THE SQUAD LEADER COMMANDS FRIEND-CEASE TRACKING
SQUAD LEADER COMMANDS CONTINUE TO TRACK
UNKNOWN TARGET
HOSTILE TARGET
GUNNER CONTINUES TO TRACK TARGET
GUNNER CEASES TRACKING CENTERS WEAPON TO PTL
TARGET LEAVES AREA
TARGET SUDDENLY ATTACKS
THE SQUAD LEADER ISSUES AN ENGAGEMENT COMMAND
GUNNER AWAITS FURTHER INSTRUCTIONS
GUNNER CONTINUES TO TRACK UNTIL SQ LDR INSTRUCTS OTHERWISE

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Engagement decision. When the squad leader has made a positive identification of a target as HOSTILE (or an UNKNOWN in WEAPONS FREE), and all other requirements for engagement as shown on the preceding illustration are met, the squad leader makes his engagement decision. He then issues the engagement command.

Engagement command. The engagement command is issued by the squad leader. It is issued to the gunner. The command must include the words "hostile" and "engage" and specify the method of engagement. Whenever the Chaparral has both basic and improved missiles on the rails, the selected missile is included in the order. A typical command would be: HOSTILE, SHOOT-LOOK-SHOOT, IMPROVED, ENGAGE. When a multiple target is to be engaged, the SHOOT-NEW TARGET-SHOOT method is used and the sequence of target engagement will be part of the engagement command. The engagement command is permissive to the gunner in that he has permission to fire whenever his fire decision is made.

Fire decision. The gunner makes his fire decision by evaluating the situation with respect to the requirements for engagement. These requirements are:

- Target is being tracked smoothly.
- Missile IR tone is satisfactory.
- Hold fire light is out.
- Engagement command has been issued.

Missile launch. The gunner launches the missile immediately after making his fire decision. If engaging a single target, the gunner attempts to reacquire the target (visual and IR) and prepares to fire another missile should another engagement command be issued. If the engagement command was for a multiple target, the gunner will engage the next target in the announced sequence as soon as he makes a new fire decision.

Kill evaluation. The squad leader watches the flight of the missile and orders the firing of additional missiles if required. He may also command the gunner to return to his PTL or alert him to another target azimuth.

ENGAGEMENT COMMUNICATIONS

Because the time for target engagement is limited, communications between squad members must be brief.

The following words and phrases, used singly or in combinations, are all of the words needed for an engagement. Talk will be held to the minimum required.

WORD/PHRASE	USED BY	DEFINITION ACTION
ABANDON TARGET		Discontinue tracking or searching for target. Resume search of assigned sector.
BASIC		Designates the basic MIM-72A missile.
CONTACT		SL/gunner has sighted correct target.
ENGAGE		Authority for the gunner to fire.
FIRE TWO		Tells gunner to launch a second missile.
FRIENDLY		Declares target to be friendly.
FRONT-TO-REAR, RIGHT-TO LEFT, LEFT-TO-RIGHT		Order of engagement for MULTIPLE TARGETS. Part of the engagement order.
HIGH		Target is in excess of 400 meters above terrain.
HOLD FIRE		Gunner does not launch a missile. Continues tracking.
HOSTILE		Target visually identified as enemy.
IMPROVED		Designates the improved MIM-72C missile.
LOW		Target is less than 400 meters above terrain.
MULTIPLE		A raid of more than one aircraft.
ONE O'CLOCK through TWELVE O'CLOCK		Indicates direction to target.
ROGER		I understand.
SAY AGAIN		Repeat last sentence.
SHOOT-LOOK SHOOT		Technique for single aircraft raids.
SHOOT-NEW TARGET-SHOOT		Technique for multiple aircraft raids.

EXAMPLES

HOSTILE, SHOOT-LOOK-SHOOT, IMPROVED, ENGAGE	Enemy aircraft. Gunner will fire improved missile. SL will evaluate first missile, gunner will reacquire target and prepere to fire agein if SL commands.
HOSTILE, SHOOT-NEW TARGET-SHOOT, BASIC, FRONT-TO-REAR, ENGAGE	Enemy aircraft. More than one. Gunner will fire at as many as possible, starting with the front aircraft.
TARGET, 2 O'CLOCK, LOW	Aircraft sighted at 2 o'clock, less than 400 meters altitude.
WARNING: AIRCRAFT, 2 2 O'CLOCK	Early warning information. Aircraft reported approaching from 2 o'clock.

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POST ENGAGEMENT ACTIONS

Upon completion of any combat action the squad will—

- Report the action to platoon headquarters, stating—
  - Results, i.e., aircraft hits, kills.
  - Personnel casualties.
  - Ready for combat status (if not ready, give reason).
  - Ammunition status.
  - Recommendation for moving to alternate site.
- Reload rails.
- Move to and emplace at an alternate site, if directed.
- Camouflage newly occupied position.
- Report location and ready status to platoon headquarters.

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Accurate visual recognition of aircraft is essential to Chaparral crewmen in making their engagement decision. It is vital that recognition be *swift* and *accurate*. Individual crewmen should be experts at recognizing all friendly and potentially hostile aircraft expected to be operating at low altitudes in a specified combat zone. Each Chaparral crewman should approach 100 percent recognition accuracy with 90 percent being a minimum acceptable level of proficiency.

Aircraft recognition training for ground observers is covered in detail in TC 44-30, Aircraft Recognition Training For Ground Observers. This training circular should be used as a guide for planning and conducting aircraft recognition training in Chaparral units. The TC tells instructors how to use TEC and GOAR methods of instruction as well as the training aids used with recognition training. It also provides information on how to plan and prepare a training program in this subject. Furthermore, it can be used by those persons who establish training requirements and who evaluate job proficiency of individuals and the combat readiness of Chaparral units.

TRAINING FILMS

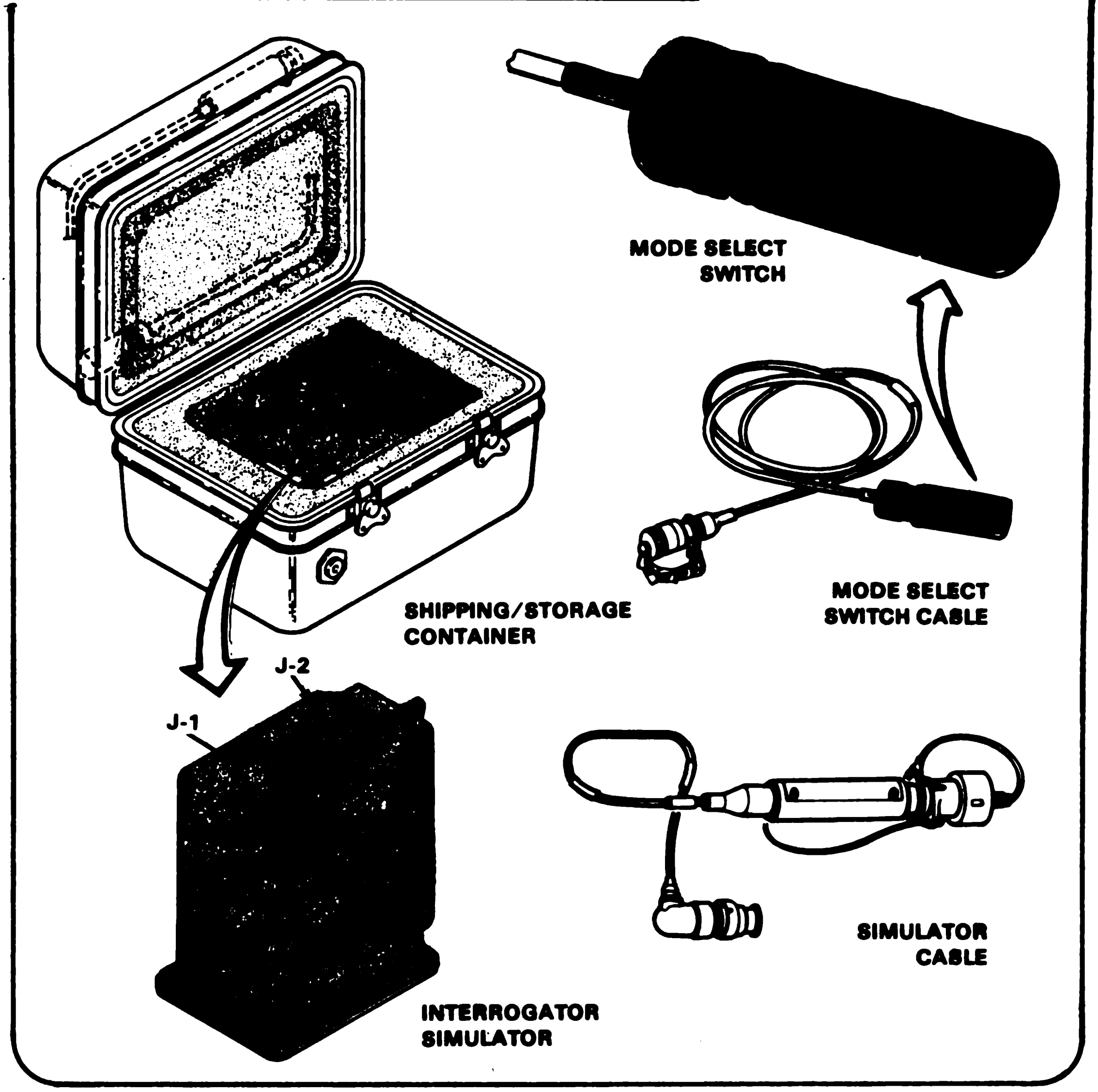
US Army training films can be used to support instruction of Chaparral crewmen in both Army-wide skills and in Chaparral operations. DA Pam 108-1, Index of Army Motion Pictures and Related Audio-Visual Aids, is a guide to available training films. Of particular interest to trainers are the:

- 44-Series of films relating to Chaparral and associated equipment.
- 21-Series of films relating to the individual soldier.
- 5-Series of films relating to camouflage and field fortifications.
- 8-Series of films relating to first aid and field sanitation.

In addition to training films, other audiovisual materials are indexed in DA Pam 108-1.

Films and projection equipment are obtained from training and audiovisual support centers.

IFF SUBSYSTEM TRAINING SET



The IFF subsystem training set consists of an interrogator simulator, a simulator cable, a mode select switch cable, and a shipping/storage container.

The interrogator simulator is used in place of the tactical interrogator for training purposes. The simulator is identical in size, appearance, and operation to that of the tactical interrogator, with a few exceptions:

- Twelve gold 1-inch squares around the center of the simulator.
- The simulator draws its power from the launching station through the W71 cable harness.
- Two specially-designed cables are used with the simulator.

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A simulator cable replaces the interrogator cable. Unlike the tactical interrogator which relies on internal battery power, the simulator operates on Chaparral system power. A voltage regulator within the simulator cable converts Chaparral system voltage to the voltage required by the simulator. The simulator cable is connected in the same manner as the interrogator cable.

The mode select switch cable has a five-position control switch on one end. The end is left outside of the gunner's compartment and allows the squad leader/evaluator to select one of five operating modes for the simulator:

- Mode 4 friend.
- Mode 3 friend.
- Unknown.
- Self-test fail.
- Random (a mix of Mode 4 friend, Mode 3 friend, and unknown tones).

The other end of the cable is connected to the J2 jack on the simulator. When the gunner presses the IFF challenge button, the simulator generates the response tones of the selected mode. The tones produced by the simulator are identical to those produced by the interrogator. Gunner reaction to the IFF tones is then observed and evaluated.

The shipping/storage container provides storage and protection for the simulator and training set cables.

The complete training set is available at platoon headquarters.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Designates posts, primary target line, reference point, search sectors, and primary field of fire. Explains tactical situation and gives instructions regarding local security.				
Commands, PREPARE FOR ACTION. Monitors vehicle communications, assumes duty of local security, and supervises the squad.	Falls out and moves to the rear of vehicle, verifying that UPLOCK LEVER is in the UNLOCK position as he passes it.	Transfers communications and security responsibilies to the squad leader.	Falls out and double times to the rear of the vehicle.	Falls out.
	Assisted by No. 3, lowers vehicle tailgate.	Dismounts and, assisted by No. 4, checks the radiator water level, and the oil level of the engine, transmission, differential, and final drives. Assisted by No. 4, unfolds and latches blast covers into firing position.	Assists No. 1 in lowering the vehicle tailgate.	Assists No. 2 in performing after-operation checks. Assists No. 2 in unfolding and latching the blast covers into firing position.
	Energizes the battery heater, if required.	Closes left cab door.		
	Opens rear electrical compartment access door.	Checks the tracks and road and idler wheel oil levels.		
	Checks to insure battery charge indicator reads in the yellow zone.			
	Sets PRIME POWER rotary switch to MANUAL.			
	During the 1-minute purging period, sets MASTER POWER Switch to ON. Sets and holds LAMP TEST switch to ON. Observes that all lamps are lit. Releases switch.			
	Verifies the ERECT/RETRACT circuit breaker is ON. Erects mount approximately 2 inches to insure the battery charge indicator needle does not dip into the red zone.			
	Closes rear electrical compartment access door.			

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SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
	Steps up on launching station deck, opens canopy, enters gunner's compartment, closes canopy, and checks for light leakage.		Energizes main power unit (MPU) by pressing and holding the push-to-start button until MPU starts.	
	Puts on gunner's headset, rotates gunner's sight into position, and adjusts gunner's seat.			
	On the center control panel, verifies TRIGGER LOCK switch is turned to OFF and the key is out.			
	Sets the POWER SUPPLY, MOUNT DRIVE, and MOUNT CONDITIONING circuit breakers to ON.			
	Sets the MOUNT POWER switch to ON. Sets the MOUNT CONDITIONING and BLOWER switches as desired.	After above checks are completed, reports, VEHICLE READY.		
	Adjusts sight reticle illumination, sets BRIGHT/DIM switch to BRIGHT. Verifies lamps brighten. Sets BRIGHT/DIM switch to DIM.		Sets and holds mount ERECT/OFF/RETRACT switch at ERECT until mount is fully erected. Releases switch.	Sets UPLOCK LEVER to the LOCK position.
	Announces READY FOR IFF CHECK.			
Insures crewmembers are not in front of Launching Station. Moves away from front of Launching Station.		Moves away from front of Launching Station.		
Announces CLEAR FOR IFF CHECK.				
	Presses IFF challenge switch, and listens for UNKNOWN tone. Reports tone or lack of tone (SELF TEST FAIL) to SL.			
	Observes that the MOUNT STRUCTURE interlock lamp is out.			Opens crew equipment compartment and obtains two TA-312/PT telephone sets, one C-2328/VRC GRA 39 remote control unit, one TADDS unit, two pairs of binoculars, and three reel units of DR/8 field wire
	Sets and holds LAMPS TEST switch to TEST. Verifies all lamps are lit. Releases LAMPS TEST switch.	Assists squad leader in providing local security.		

			from the crew equipment compartment.
Turns COMMUNICATIONS rotary switch to INTERCOM AND RADIO RCVR. Verifies that the radio can be heard through the gunner's headset (rushing noise).		Steps up on launching station deck, checks condition of missiles, checks that safety streamer pins, wings, and fins are securely attached.	Places one telephone set, one reel unit with field wire, and one set of binoculars on the side of the launching station deck (left or right side can be designated by the leader).
Directs No. 3 to remove missile dome protective covers, rolleron protective covers, and safety pins and streamers from each launch rail.		Removes missile dome protective covers, rolleron protective covers, and safety pins and streamers as directed by No. 1. Places them in the vehicle cab.	
Performs missile preoperational checks as follows:			
Verifies ARM switch is OFF. Turns MODE selector switch to TEST. Observes that one MISSILE SELECTION lamp lights. Cycles SEQUENCE ADVANCE switch three times; observes that the three remaining lamps light.			
Instructs No. 3 to replace safety pins and streamer pins, unless actual battlefield condition exists.		Replaces safety pins and streamer, unless actual battlefield condition exists.	Places one telephone set, TADDS unit, remote control unit, two reel units with field wire, and one set of binoculars on the launching station deck (left or right side can be designated by SL).
Cycles sequence advance switch to all four positions. Waits one minute at each position for missile to cool.			
	Obtains one TA-312/PT telephone set and one set of binoculars; takes them to the forward observation post.	Determines that there is no background IR source.	
Directs No. 3 to hold the IR flashlight approximately 1 foot in front of and off center of each missile seeker and monitors missile tone of each seeker.		When directed by No. 1, holds IR flashlight approximately 1 foot in front of and off center of missile seeker selected by No. 1.	Closes crew equipment compartment.
Sets MISSILE CAGE/UNCAGE switch at UNCAGE and checks that missile tone nulls (MIM-72A & B), and that			

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SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
	missile tone does not null for the MIM-72C (Improved).			
	Opens canopy, checks that the launching station deck is clear, closes and latches canopy.		Steps down from launching deck, turns PRIME POWER rotary switch to AUTO.	Steps down from launching station deck.
			Assisted by No. 4, closes and latches tailgate.	Assists No. 3 in closing tailgate.
	Verifies both action switches operate by pressing each switch and rotating the hand control, observing the DRIVE SYSTEM warning lamp goes out, the mount traverses, and the launch rails elevate and depress.		Reports, MISSILES READY.	Connects wires to appropriate INTERCOM terminals and RADIO terminals. Reports, COMMUNICATIONS READY.
After receiving reports from all squad members, transfers commo to NO. 1.	Reports LAUNCHING STATION READY.		Obtains two reel units of field wire and one TA-312/PT telephone set. Lays wire to the squad command post.	Obtains one reel unit of field wire from the launching station deck and lays wire to the forward observation post.
Closes right cab door.	Assumes communications.			
Obtains remote control unit, the TADDS unit, and one set of binoculars from the launching station deck. Takes them to command post.	Conducts a communications check with the forward observation post and squad command post.	Conducts a communications check with No. 1 and the squad command post.	Connects INTERCOM wires to the telephone set and conducts a communications check with the senior gunner and the forward observation post.	Connects field wire to the TA-312/PT telephone set. Reports to No. 2 that he is ready for action.
Connects RADIO wire to the remote control unit and conducts a communications check with platoon headquarters. Emplaces and orients the TADDS unit to magnetic north and plots the fire unit and FAAR unit positions on the TADDS matrix.				
Assumes communications.	Transfers communications to SL.			
Records azimuth indicator reading of reference point as reported by No. 1.	Reports the azimuth indicator reading of the reference point to the squad leader and the forward observation post.	Records the azimuth indicator reading of the reference point as reported by No. 1.		

Notifies No. 1 of the mode to use.	Turns MODE selector switch to mode selected by the squad leader. Reports to the squad leader over the intercom, SYSTEM READY FOR ACTION.			
Commands squad to begin search and scan of their assigned sectors of search. Reports to the platoon headquarters, SQUAD READY FOR ACTION.		Begins search and scan procedures of assigned sector alternating with No. 4.	Begins search and scan procedures of assigned sector alternating with the squad leader.	Begins search and scan procedures of assigned sector alternating with No. 2.

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TARGET ENGAGEMENT

The following steps are based on an air defense warning RED and weapons control status of weapons tight.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Searches the azimuth reported by the observer.	Slews the mount to the direction of approach and searches for the target.			
When he sights the target, announces, CONTACT.				
Repeats target location to No. 1.	Locates target. Places target in sight reticle and announces CONTACT to SL. Presses IFF challenge switch.			
Listens to IFF response.		Nos. 2, 3, and 4 resume search of their assigned sectors.		
Identifies target and, if single and hostile, commands, HOSTILE, SHOOT-LOOK-SHOOT, (BASIC, IMPROVED) ENGAGE.				
	Tracks target smoothly and listens for best IR tone; when tone is received, announces TONE over intercom.			
	When he has a good missile tone, and HOLD FIRE lamp is not lit, launches missile.			
Observes the missile flight. When missile explodes, determines target damage. If target is not destroyed, commands, No. 1, FIRE TWO.	Reacquires target as rapidly as possible and prepares to fire a second missile, if required.			
When target is destroyed, commands, ABANDON.	Returns to assigned sector or primary target line.			

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Target Engagement, Multiple Targets. The following steps are based on an air defense warning RED and weapons control status of weapons tight.

SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
Searches the azimuth reported by the observer.	Slews the mount to the direction of approach and searches for the target.			
When he sights target, announces, CONTACT, to observers.	Sights targets and announces CONTACT to SL. Presses IFF challenge switch.			
Listens to IFF response.		Nos. 2, 3, and 4 resume search of their assigned sectors.		
Identifies target and if hostile, commands, HOSTILE, (FRONT-TO-REAR, REAR-TO-FRONT) SHOOT-NEW TARGET-SHOOT. (BASIC, IMPROVED) ENGAGE.				
	Tracks target smoothly and listens for best IR tone; when tone is received, announces TONE over intercom.			
	Checks that HOLD FIRE lamp is not lit.			
	When good missile tone is heard and HOLD FIRE lamp is out, launches missile.			
	Acquires a new target and repeats steps above.			
Assesses target damage; orders CEASE FIRE when targets are destroyed or out of range.				
	Returns to assigned search sector or to primary target line.			

POST-ACTION DRILL

General. After completing an engagement, it may be necessary to displace Chaparral to an alternate position to avoid being targeted by enemy ground fire or attacked by hostile aircraft. If a move of considerable distance is required and time and the tactical situation permit, the displacement should be conducted as described below. If the tactical situation is urgent and displacement must take place immediately, the procedure described in Emergency Displacement should be followed.

Normal Displacement. This drill procedure is based on the squad members being located at their tactical positions. The squad leader will order the displacement upon receipt of orders from platoon headquarters. Normal displacement drill is outlined as follows:

Using the intercom, commands, **MARCH ORDER.**				
Closes and secures TADDS.	Sets and holds LOAD/OFF/STOW switch at STOW until mount is positioned at 6 o'clock and the launch rails at 0°.	Disconnects field wire from telephone.	Disconnects field wire from telephones.	Carries the telephone and binoculars to the vehicle.
Disconnects field wire from remote control unit.			Returns to the vehicle and places telephones on the launching station deck.	
Carries binoculars, TADDS, and remote control unit to the weapon.		Returns to the vehicle, reeling the field wire.	**Opens tailgate, assisted by No. 4.**	Assists No. 3 in opening tailgate.
	Stows the sight; turns TRIGGER lock switch to OFF.	Disconnects the field wire from the external communications panel and places the reel on the launching station deck.	Reels up the three reels of field wire, disconnects them from the external communications panel, and places them on launching station deck.	Climbs on to launching station deck, opens crew equipment compartment.
Reestablishes radio communications with platoon headquarters, using the vehicle cab communications.	Removes key.	Assisted by No. 3, stows blast shields.	Assists No. 2 in stowing blast shields.	Removes the missile dome protectors and lays them on the deck.
Acts as local security while the squad is preparing for march order.	Removes and stows the gunner's headset.	Performs before-operation checks on the vehicle.		As the SL, No. 2, and No. 3 return equipment, stows it in the crew equipment compartment.
		Reports, VEHICLE READY.	Assists No. 4 in stowing equipment.	Closes and latches the compartment doors and notifies No. 1 that the launching station deck is clear.
				Sets UPLOCK LEVER to UNLOCK.
				Reports, EQUIPMENT READY.

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SL SQUAD LEADER	① GUNNER	② DRIVER	③ OBSERVER	④ OBSERVER
	Verifies that UPLOCK LEVER is at UNLOCK.			
Receives reports from squad as their tasks are completed.	Sets and holds the ERECT/OFF/RETRACT switch at RETRACT until mount is fully retracted.			
	Opens canopy, dismounts, closes, and latches canopy.			
	Replaces missile dome protectors.			
	Assisted by No. 3, raises and locks vehicle tailgate.		Assists No. 1 in raising and locking tailgate.	
	Reports, MOUNT READY.			
When the squad has reported ready, commands, MOUNT.				
	Mounts cab through right door after No. 3.	Mounts cab through left door and puts on headset.	Mounts cab through right door after No. 4.	Mounts cab through right door.
When No. 2 has mounted, transfers communications to No. 2.		Starts engine, reports, READY.		
Inspects Chaparral to insure that all equipment is secured.				
Mounts cab through right door, takes over communications.		Returns communications to SL, takes off headset.		Puts on headset and monitors the R-442/VRC.
When engine is started, commands, MOVE OUT.				
Directs No. 2 in operating the vehicle.		Drives Chaparral over the directed route.		

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APPENDIX A

REFERENCES

AR 380-40	(o) Policy for Safeguarding and Controlling COMSEC Information
AR 385-62	Regulations for Firing Guided Missiles and Heavy Rockets for Training, Target Practice and Combat
DA Pam 108-1	Index of Army Motion Pictures and Related Audio-Visual Aids
FM 21-6	How to Prepare and Conduct Military Training
FM 44-1	US Army Air Defense Artillery Employment (How to Fight)
FM 44-3	Air Defense Artillery Employment: Chaparral/Vulcan (How to Fight)
FM 44-6	Operations and Training, Forward Area Alerting Radar (FAAR) and Target Alert Data Display Set (TADDS)
FM 44-16P	Soldier's Manual, 16P Short Range Air Defense Artillery Missile Crewman
FM 44-20	Service Practice for Air Defense Artillery Units
FM 44-23	US Army Air Defense Employment, Redeye (How to Fight)
FM 44-23-1	Operations and Training, Redeye
FM 44-102	Procedures for Ballistic Aerial Target System
TM 9-1300-206	Ammunition and Explosive Standards
TM 9-1410-585-24	Organizational, DS and GS Maintenance Manual, Chaparral Intercept Aerial Guided Missile MIM-72A and MIM-72B, Chaparral Training Missile M30, (U)
(C) TM 9-1410-586-24	Chaparral Intercept Aerial-Guided Missile MIM-72C and Supporting Equipment
*TM 9-1425-1585-10-1	System Description of Chaparral Air Defense Guided Missile System
*TM 9-1425-1586-10	Operator's Manual, Chaparral M48A1, Intercept-Aerial Guided Missile System

*To be published.

*TM 9-4935-1587-14	Operator, Organizational, and DS/GS Maintenance Manual for Shop Equipment AN/TSM-95A
TM 9-6920-585-12	Operator and Organizationzal Maintenance Manual, Monitoring Set, Guided Missile System, Training, AN/TSQ-T3 (XO-2)
TC 21-5-3	TEC Management Instruction
TC 21-5-7	Training Management in Battalions
TC 44-30	Aircraft Recognition Training for Ground Observers

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